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ANNUAL REPORT

OF THE

ASSOCIATION

OF

Ontario Land Surveyors

ORGANIZED 1886. INCORPORATED, 1892.

TORONTO

1900.

The next Annual Meeting will be held at Toronto on
Tuesday, Feb, 26th and following days.

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No. 15.

ANNUAL REPORT

OF THE

ASSOCIATION

OF

Ontario Land Surveyors

ORGANIZED 1886. INCORPORATED 1892.

AND

PROCEEDINGS

AT THE

EIGHTH ANNUAL MEETING
SINCE INCORPORATION

HELD AT

TORONTO

27th and 28th February and 1st March,
1900.

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NOTICES.

Members and others will be supplied with copies of the Annual Reports for 1886, 1887, 1888, 1889, 1891, 1892, 1893, 1894, 1895 1896, 1897, 1898, or 1899 upon remitting to the Secretary fifty cents, for each copy required.

Copies of the "Manual" may also be had from the Secretary, price fifty cents.

Each member of the Association is reminded of the fact that for the next Annual Meeting a good programme is most desirable, and to insure its preparation it is not now too early to bear the matter in mind.

In addition to its use as a library, the Repository now serves as a drafting room for members when copying Crown Lands plans and notes.

Published annually by the Association of Ontario Land Surveyors. Edition, 1350 copies; price, 50 cents.

PATRONISE OUR ADVERTISERS.

PREFACE.

To the Members of the Association of Ontario Land Surveyors :

The proceedings of the Association at its Eighth Annual Meeting are herewith presented.

On page 223 of this Report will be found the last additions to the "Manual" which may be removed without injury to the book and pasted into Manual thus keeping it up-to-date. Future additions will be published when necessary.

Your consideration of the advertisements appearing in our columns is requested.

Respectfully submitted on behalf of the Council,

VILLIERS SANKEY,

Secretary.

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ASSOCIATION OF

ONTARIO LAND SURVEYORS

(INCORPORATED 1892)

Organized 23rd February, 1886.

OFFICERS FOR 1900-1901.

PRESIDENT.

George Ross, O.L.S., - - - - - - - Welland.

VICE-PRESIDENT.

James Dickson, O.L.S., - - - - - - Fenelon Falls

CHAIRMAN OF COUNCIL.

George B. Kirkpatrick, O.L.S., - - - - - Toronto.

SECRETARY-TREASURER.

Major Villiers Sankey, O.L.S., - - - - - Toronto

MEMBERS OF COUNCIL.

Hon. E. J. Davis, Commissioner of Crown Lands, - Toronto

A. J. VanNostrand, Toronto. W. R. Aylesworth, Belleville.	For Term ending April, 1903.
Geo. B. Kirkpatrick, Toronto. Alex. Niven, Haliburton.	For Term ending April, 1902
J. L. Morris, Pembroke. John McArce, Rat Portage.	For Term ending April, 1901.

AUDITORS.

K. Gamble, - - - - - - - - Toronto.
H. J. Browne, - - - - - - - - Toronto.

BANKERS.

Imperial Bank of Canada (Yonge Street Branch), Toronto.

COMMITTEES, 1900-1901.

STANDING.

LAND SURVEYING.—Wm. R. Aylesworth (Chairman), J. D. Evans, Wm. Galbraith, M. Gaviller, H. H. Gibson, F. F. Miller, C. J. Murphy, A. L. Russell.

DRAINAGE.—A. S. Code (Chairman), J. A. Bell, F. W. Farncomb, F. W. Flater, T. H. Jones, W. G. McGeorge, Geo. Ross, G. Smith.

ENGINEERING.—M. J. Butler (Chairman), A. W. Campbell, J. Hutcheon, R. McDowall, A. J. McPherson, J. L. Morris, A. P. Walker, J. Warren.

ENTERTAINMENT.—H. L. Esten (Chairman), W. A. Browne, J. Dickson, H. DeQ. Sewell, T. B. Speight, A. P. Walker.

PUBLICATION.—K. Gamble (Chairman), H. J. Browne, H. L. Esten, W. A. McLean, A. J. VanNostrand.

TOPOGRAPHICAL SURVEY.—Otto J. Klotz (Chairman), M. J. Butler, W. Chipman, L. B. Stewart.

SPECIAL.

REPOSITORY AND BIOGRAPHY.—A. J. VanNostrand (Chairman), W. Chipman, R. P. Fairbairn, P. S. Gibson, T. H. Jones, G. B. Kirkpatrick, C. Unwin.

EXPLORATION.—L. B. Stewart (Chairman), G. B. Kirkpatrick, J. McAree, A. Niven, H. B. Proudfoot, H. W. Selby, G. E. Silvester.

PROGRAMME OF THE

Association of Ontario Land Surveyors

(INCORPORATED.)

AT ITS EIGHTH ANNUAL MEETING HELD IN TORONTO.

27th AND 28th FEBRUARY, 1st MARCH, 1900.

PROGRAMME.

Tuesday, 27th February—Morning at 10 o'clock.

AT THE REPOSITORY, PARLIAMENT BUILDINGS.

Meeting of Council.
Meeting of Standing and Special Committees.
Call to Order, 11 a.m.
Report of Secretary-Treasurer.
Report of Committee on Repository and Biography. Willis Chipman, Chairman.
Paper—"Samples of a Country Surveyor's Life." H. H Gibson.
Paper—"Railway Curves" H. Strange.
Paper—"Railway Work." H. K. Wicksteed.

Afternoon at 2 o'clock.

President's Address.
Paper—"The Mining Outlook." T. R. Deacon.
Paper—"Mining Regulations (Yukon.)" T. Fawcett.
Paper—"A Survey under Sec. 38, Survey Act, 1897." G. B. Kirkpatrick.
"Report of Committee on Land Surveying." H. H. Gibson.
Paper—"System of Survey." S. Bray.

Wednesday, 28th February—Morning at 10 o'clock.

Report of Committee on Publication. K. Gamble, Chairman.
Paper—"Artesian Wells" A. J. McPherson.
Report of Drainage Committee. W. F. VanBuskirk, Chairman.
Paper—"Highway Culverts." A. W. Campbell.
Paper—"Bacterial Filter Beds for Sewage Disposal." E. G. Barrow.
Report of Engineering Committee. H. K. Wicksteed, Chairman.

Afternoon at 2 o'clock.

Report of Committee on Exploration. M. Gaviller, Chairman.
Paper—"Blazed Trees." J. Davis.
Report of Council. V. Sankey, Chairman.
Report of Auditors. A. W. Campbell and H. L. Esten.
Paper—"Low Grade Ores." H DeQ. Sewell.
Paper—"The Yukon Country." E. D. Bolton.

Evening at 8 o'clock.

Paper—"Water Power." V. M. Roberts.
Paper—"Azimuth." C. Carroll.
Paper—"Azimuth from Polaris." Otto J. Klotz.
Paper—"Difficulties in Mining Laws" (Ontario.) A. J. Russell.

Thursday, 1st March—Morning at 10 o'clock.

Report of Committee on Entertainment. A. P. Walker, Chairman.
Paper—"Original Survey" (Tp. Alfred.) E. T. Wilkie.
Paper—"The Forest Trees of Ontario." W. A. McLean.
Report of Topographical Survey Committee. Otto J. Klotz, Chairman.
Nomination of Officers—(President, Vice-President, Secretary-Treasurer, Auditors, two members of Council.)

Afternoon at 2 o'clock.

Ratification of By-Laws.
Unfinished Business.
New Business.
Adjournment.

Minutes of the Eighth Annual Meeting

OF THE

ASSOCIATION OF ONTARIO LAND SURVEYORS

Held at the Repository, Parliament Buildings, Toronto,
on FEBRUARY 27th, 28th and MARCH 1st, 1900.

MORNING SESSION.

February 27th, 1900.

The eighth Annual Meeting opened at 10 o'clock a.m., the Vice-President, Mr. Ross, in the chair.

The Minutes of the previous meeting, as printed in the "Proceedings" for 1899, were taken as read, and on motion of Mr. Dickson, seconded by Mr. Kirkpatrick, were adopted.

Communications from Messrs. Schofield and Strange and the Engineers' Club were then read, and on the latter communication Messrs. Sankey and Butler spoke.

On motion of Mr. Sankey seconded by Mr. Niven, Messrs. Butler, Klotz and L. B. Stewart were appointed a Committee to bring before His Excellency the Governor-General the matter of topographical survey. Carried.

Mr. Sankey, Chairman of Council of Management, presented the Report of the Secretary-Treasurer and Financial Statement; and on motion of Mr. Sankey, seconded by Mr. Niven, the Financial Statement was submitted to the Auditors.

The President takes the chair.

The President then read a communication from Mr. Van Nostrand, resigning the position of Secretary-Treasurer of the Association.

The President—I have here a communication, gentlemen, which will probably be a surprise to the most of you. I think before we deal with it we will have to hear from the Secretary-Treasurer.

Mr. Van Nostrand—Mr. Chairman, I think the time has come, after ten years of one Secretary, for a change. I have been very much interested in the work, and I have enjoyed it all through; but I find it takes up more of my time than under present circumstances I can afford to give, for I cannot do the Association work justice and attend to my own business, and I am afraid that the Association's business rather suffered last year on account of my own business being a little greater than it had been previously; I have, therefore, come to the conclusion that I must resign, and I think this is the best time to do so. We will have our nomination and election of officers presently, and, as a new Secretary will have to be appointed, it will be well for him to get into the traces as early as possible, the usual way is to appoint one pro tem.

The President—I certainly am very much taken by surprise by the Secretary's resignation, as I had hoped that he would continue to give the Association his services for many a year to come, perhaps it would be well for the Association to make it worth his while to continue as Secretary.

Mr. Van Nostrand—I trust that the members of the Association will not look at it in that light. The Association has dealt very generously with me. A great deal of the work that has been performed has been merely clerical work, and the Association should not pay more than clerical pay for it. Unfortunately I have professional work on hand which interferes with it. My resignation stands, and my thanks are due to the members of the Association for the way in which they have always treated me financially.

Mr. Sankey—Under the circumstances I would like to say a few words. Nobody in the whole Association knows what Mr. Van Nostrand has done for the Association as well as I do, and I cannot express to you what I feel at the loss the Association is sustaining. When Mr. Van Nostrand became our Secretary we were in our absolute infancy, and you see by his report this year the position we now stand in. We are in a strong financial position as well as in a strong professional position to-day, stronger, I think, than we have ever been in before. Personally I would be very glad if Mr. Van Nostrand would reconsider his decision. He told me privately of his decision some time ago. I urged him to reconsider it, and he said he would, but the reconsideration resulted in the same statement that he found that it was a matter between his professional duties and the Association, and under the circumstances the professional duties must prevail. I wish that someone's voice here would have more effect with him than what I have said to him, or what others have said to induce him to remain with the Association as its Secretary, has had. You have heard what he has said; and I would like to bear testimony, as Chairman of the Council, to the very great value of Mr. Van Nostrand's services, and to express my very sincere regret at his finding it necessary to sever his present connection with us.

Mr. Niven—Mr. President, I am very sorry, indeed. that Mr. Van Nostrand has arrived at the conclusion that he can no longer hold the office of Secretary-Treasurer. We have been very fortunate in our Secretary-Treasurers. A number of years ago, when Mr. Chipman resigned, Mr. Van Nostrand was elected in his place, and I had hoped that he would have been our perpetual Secretary. However, as he seems to have made up his mind to give up the office, conflicting as it does with his professional duties, I do not think that we can press him to retain it. I do not like to move the acceptance of his resignation, hoping that something would turn up to keep him in office. I would suggest in the meantime that Captain Gamble be asked to assist him in his duties during this meeting.

Mr. Van Nostrand—It may be out of order for me to speak a third time on the same question; but I still think that someone should have the responsibility who is going to continue in the office. Although it is a matter for the Association to say when the time for election comes on, still they will be guided to some extent by what is done now; and if some one present can decide on some one who will probably take the position and hold it, that may affect the election to a certain extent. I do not think that the assistant arrangement will be workable. I shall be very glad to do what I can to assist the new Secretary, but I do not like to have the responsibility of doing his work altogether. I have considered the question of possible successors, and it struck me that possibly Captain Gamble or Major Sankey, or some one who has not got his time fully occupied by professional duties, might undertake it. I do not know what the sentiments of these gentlemen are; but I would be very glad to propose Mr. Sankey's name for the present in any event.

Mr. Ross—I take very great pleasure in seconding Mr. Sankey's name as the Secretary to succeed Mr. Van Nostrand. Mr. Sankey has been one of the fathers of the Association, and if he would take the position, I think he would be very acceptable to every member of the Association.

Mr. Dickson—Mr. President, from my first connection with the Association I have had very pleasant business and friendly connections with Mr. Van Nostrand, and it is with very great regret that I see he has made up his mind to sever his connection with the Association as its Secretary. I think I express the sentiments of every member here when I say that we universally regret that he has found it necessary to resign his position, and, although I do it very reluctantly, I beg leave to move that Mr. Van Nostrand's resignation be accepted.

Mr. Kirkpatrick—I will second that, but I do not like it at all. Like all the others, I looked forward to Mr. Van Nostrand being our Secretary; in fact I could not imagine him being anything else, because he is such a good-natured man that there is no possibility of anyone ever quarrelling with him—I do not think anyone ever did, and I am very sorry, indeed, that he has found it necessary to give up the position. At the same time I am glad to find that his business is looking up, so that he felt called upon to give up his whole time to his own work. It is a sign of the growing time we hear so much of, and I hope that it will be only an evidence of the growing time for the remainder of us surveyors. I suppose, as Mr. Van Nostrand has said that his determination is unalterable, the only thing for the Association to do is to accept his resignation with deep regret, expressing to him at the same time the deep sense of gratitude we all feel for the wonderful care which he has bestowed upon the interests of the Association, which as we all know, lie very much in the hands of the Secretary.

The President—Moved by Mr. Dickson, seconded by Mr. Kirkpatrick. that the resignation of the Secretary-Treasurer, Mr. A. J. Van Nostrand, be accepted with regret.

I am sure that we all feel that it goes against the grain to say "Aye" to this motion, but knowing the Secretary-Treasurer, we know that when he has made up his mind that a step is right he will stick to it, and it seems he considers this step necessary; so that with much regret I will have to ask you to signify your assent to this motion.

Mr. Kirkpatrick—Would it not be well to have an Acting Secretary appointed? Or is Mr. Van Nostrand going to continue as Secretary during this meeting? If not, I would move that Mr. Sankey be Acting Secretary, if he will kindly accept it.

Mr. Dickson—I second the motion.

Mr. Sankey—Mr. President, this matter is rather new to me, but if you think it would be well for me to be Acting Secretary during this meeting, I will accept the position during the meeting, and until the Association has an opportunity of discussing what is really for its interests. I may say, as Chairman of the Council, that it is a matter of very great importance to this Association who takes Mr. Van Nostrand's place. The Chairman of the Council cannot do everything; he may assist, he may give advice, but it is the Secretary to whom the Association has to look practically for the carrying on of the business of the Association, and it is a matter, as I have said before, of very great importance who takes this office; it should not be just let go by chance; the duties have got to be considered, and the facilities for performing those duties have a great deal to say to their successful performance. In the meantime I shall be willing to act, knowing, as I do, that Mr. Van Nostrand will give me all the help he can.

Moved by Mr. Dickson, seconded by Mr. Kirkpatrick, that Mr. Van Nostrand's resignation be accepted. Carried.

Moved by Mr. Kirkpatrick, seconded by Mr. Dickson, that Mr. Sankey be Acting Secretary. Carried.

Moved by Mr. Dickson, seconded by Mr. Dickson, that this meeting now adjourn until 2 o'clock. Carried.

AFTERNOON SESSION.

The President, Mr. H. J. Bowman, in the chair.

The President announces receipt of telegram from Mr. T. H. Jones, regretting that he cannot attend.

A paper, "Railway Curves," by Mr. H. Strange, was read by Mr. L. B. Stewart.

Moved by Mr. Stewart, seconded by Mr. Kirkpatrick, that the paper by Mr. Strange be received and printed in the "Proceedings." Carried.

A paper, "Samples of a Country Surveyor's Life," by Mr. H. H. Gibson, was read by the writer. A short discussion took place upon this paper, after which it was, on motion, ordered that this paper be received and printed in the "Proceedings" of the Association.

The President then read his address, which was received with much applause, after which the President requested that the members present would discuss the propositions which he had made therein, upon which considerable discussion followed.

Paper, "Mining Regulations (Yukon)," was read by Mr. Fawcett, writer of same. After discussion thereon the paper was, on motion, received and ordered to be published.

Paper by Mr. Kirkpatrick, "A Survey under Sec. 38, Survey Act, 1897," was read by him, and on motion of Mr. Sewell, seconded by Mr. Niven, the paper was received as read, and ordered to be printed in the "Proceedings."

On motion it was decided to postpone the reading of Mr. T. R. Deacon's paper "The Mining Outlook," until to-morrow morning.

The meeting then adjourned at 6 o'clock until to-morrow morning, as the annual dinner of the Association took the place of an evening session.

MORNING SESSION.

Tuesday morning, Feb. 27, 1900.

Meeting called to order at 10 o'clock by Mr. Ross.

Paper by Mr. T. R. Deacon, "The Mining Outlook," read by Mr. Van Nostrand.

It was moved by Mr. Van Nostrand, seconded by Mr. H. H. Gibson, that Mr. Deacon's paper on "The Mining Outlook" in Western Ontario be received and printed in the "Proceedings." Carried.

Report of Committee on "Land Surveying" was then read; and on motion of Mr. H. H. Gibson, seconded by Mr. Niven, the Report was received and adopted.

AFTERNOON SESSION.

The President in the chair.

Paper, "Blazed Trees," was read by Mr. Davis; and after discussion, on motion of Mr. Niven, seconded by Mr. H. H. Gibson, that Mr. Davis' paper be received and printed in the Minutes, and that a vote of thanks be rendered to Mr. Davis. Carried.

Mr. D. De Q. Sewell's paper on "Low Grade Ores" was then read and discussed; and on motion Mr. Sewells' paper was received, and ordered to be printed in the "Proceedings."

The paper on "Artesian Wells," prepared by Mr. A. J. McPherson, was read by Mr. H. H. Gibson; and after a very lengthy discussion it was resolved, on motion, that this paper be received and printed in the "Proceedings."

The paper prepared by Mr. E. G. Barrow on "Bacterial Filter Beds for Sewage Disposal," was read by Mr. A. J. Van Nostrand, and on motion the same was received and ordered to be printed in the "Proceedings."

The Report of the Council of Management was read by Mr. Villiers Sankey. With the Report he also presented the Report of the Board of Examiners.

It was moved by Mr. Dickson, seconded by Mr. Watson, that By-laws Nos. 1-46, as printed in the Annual Report for 1899, and the Rules for the Board of Examiners be hereby ratified, and the motion carried.

Mr. Villiers Sankey moved the adoption of the Report of the Council of Management, seconded by Mr. Niven and carried.

Paper, "The Yukon Country," was then read by Mr. E. D. Bolton; and on motion of Mr. P. S. Gibson, seconded by Mr. Wilkie, the paper was received and ordered to be printed in the "Proceedings."

EVENING SESSION.

The Vice-President, Mr. Ross, in the chair.

Paper on "System of Survey," written by Mr. S. Bray, was read by Mr. W. H. J. Wilkie.

It was moved by Mr. Van Nostrand, seconded by Mr. E. D. Bolton, that Mr. Bray's paper be received and printed in the Proceedings. Carried.

Paper, "Highway Culverts," prepared by Mr. A. W. Campbell, was then read by Mr. A. J. Van Nostrand, and after discussion it was moved by Mr. Niven, seconded by Mr. Wilkie, that Mr. Campbell's paper be received and printed in the Proceedings. Carried.

Mr. C. Carroll's paper on "Azimuth" was read by Mr. L. B. Stewart, and discussed; and on motion of Mr. Niven, seconded by Mr. Speight, the paper was received and ordered to be printed in the Proceedings; and the thanks of the Association were rendered to Mr. Carroll and Mr. Stewart for the paper and the explanations.

Paper on " Water Power," by Mr. Roberts, was read by Mr. Van Nostrand and discussed.

It was moved by Mr. Niven, seconded by Mr. Speight, that the paper be received and printed in the Proceedings.

The meeting adjourned at 10 o'clock until 10 o'clock to-morrow morning.

MORNING SESSION.

February 28th, 1900.

The President called the meeting to order at 10 o'clock.

Paper, "Azimuth from Polaris," which was prepared by Mr. Otto J. Klotz, was read by Mr. Stewart. It was moved by Mr. Dickson, and seconded by Mr. Ross, that a vote of thanks be sent to Mr. Klotz for his valuable paper, and that the same be received and printed in the "Proceedings."

The following communication on " Magnetic Declination," by Mr. Otto J. Klotz, was read by the President; and on motion by Mr. H. H. Gibson, seconded by Mr. Van Nostrand, it was resolved that the matter of collecting data on magnetic declination be referred to the Land Surveying Committee to take action thereon during the coming year:

The time has arrived for the systematic compilation of all magnetic data in Canada. Apart from its great scientific value in the study of terrestrial magnetism, the subject has a very important practical bearing, too, as nearly all the original surveys in the older Provinces of the Dominion were made with the compass. Due to the secular variation in the magnetic declination, the bearing of many of the old lines run differs now widely from the original one. The knowledge of this change or variation is of great importance in retracing boundaries of properties. By means of a large collection of magnetic data we will also be able to discover deflections of the needle due to local disturbances, and thereby adjust apparent anomalies. The scope of this work naturally falls within the sphere of the Dominion.

Besides obtaining from the various Provincial Crown Lands offices the available data from the old records and surveys, it is intended to solicit the co-operation of every surveyor throughout Canada by getting any data that he may have pertaining to magnetic declination, or 'variation,' as popularly known. For that purpose blank forms will be supplied.'

DISCUSSION.

Mr. Van Nostrand—I suppose that is intended to take effect in the Association, and that the Association will furnish blank forms. There is no doubt that there should be a compilation of data regarding magnetic declination. Mr. Kirkpatrick referred to it in his paper. There is great dearth of that sort of information in Canada. We have to go to the other side of the line, and make a sort of estimate as to how our declination should bear on different points in the United States. And this Association ought to try to give all the assistance it can in the collection of data.

The President—This communication had better be referred to the Land Surveying Committee, or some action be taken in collecting data?

Mr. Gibson—I think it ought to go to the Secretary.

The President—If anything is to be done it is hardly fair to leave it to the Secretary alone to take action.

Mr. H. H. Gibson—I would make a motion that this matter be referred to the Land Surveying Committee. If they have something definite in hand they will probably take a little more time to it.

Mr. Ross—I will second that.

Mr. Kirkpatrick—Before going on to the next paper I would ask the Association to suspend the Rules of Order for a minute until I introduce a resolution to have placed on record when there is a full house, not to wait until this afternoon, when, perhaps, there will not be so many present.

Mr. Kirkpatrick—Mr. President, we are all aware that in the wisdom of the Governor-General and the Dominion Cabinet a member of our Association has been lately called to the high dignity of a member of the Senate of the Dominion of Canada; and I thought it would be a graceful act to place on record our sense of the appreciation of the honor done, not only to that gentleman himself, but also to the Association of Ontario Land Surveyors, of which he is a valued member. We had the pleasure of having him at our annual dinner the other night; and what gave us a peculiar pleasure in his presence on that evening was this, that although not a British Canadian, but a French

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[illegible]

Report of Publication Committee read.

Moved by Capt. Gamble, seconded by Mr. Speight, that the Report of the Publication Committee be received and adopted. Carried.

Report of the Exploration Committee read.

It was moved by Mr. P. S. Gibson, seconded by Mr. Niven, that the Report of the Exploration Committee be received and adopted. Carried.

Moved by Mr. H. H. Gibson, seconded by Mr. Roger, that the paper by Mr. W. A. MacLean, "The Forest Trees of Ontario," be taken as read and printed in the "Proceedings," and the thanks of the Association be rendered to Mr. MacLean for his work in its preparation. Carried.

Paper, "Original Survey" (Township of Alfred), was then read; and it was moved by Mr. Dickson, seconded by Mr. Kirkpatrick, that a hearty vote of thanks be tendered to Mr. Wilkie for his paper, and that it be printed in the "Proceedings." Carried.

Report of the Drainage Committee was then read by Mr. W. F. Van Buskirk; and on motion of Mr. Dickson, seconded by Mr. H. H. Gibson, it was resolved that the Report of the Drainage Committee be received and adopted.

Moved by Mr. Van Nostrand, seconded by Mr. Van Buskirk, that the paper on "Railway Work" by Mr. H. K. Wicksteed be taken as read and printed in the "Proceedings." Carried.

Moved by Mr. Ross, seconded by Mr. Rogers, that the Report on the Committee of Entertainment be taken as read and printed in the "Proceedings." Carried.

Moved by Mr. Dickson, seconded by Mr. Shaw, that the Report of the Committee on "Engineering" be taken as read and printed in the "Proceedings." Carried.

The President announced that in the absence of Mr. Chipman there is no Report as yet of the Committee on "Repository and Biography," but no doubt it will be forthcoming.

Moved by Captain Gamble, seconded by Mr. Ross, that the Report of the Committee on "Repository and Biography" be taken as read and printed in the "Proceedings." Carried.

NOMINATION OF OFFICERS:

PRESIDENT.

Moved by Mr. Dickson, seconded by Mr. Niven, that Mr. George Ross be President of the Association for the coming year. Carried.

VICE-PRESIDENT.

Moved by Mr. Ross, seconded by Mr. P. S. Gibson, that Mr. Dickson be Vice-President for the coming year. Carried.

SECRETARY-TREASURER.

Moved by Mr. P. S. Gibson, seconded by Mr. Niven, that Mr. Villiers Sankey be Secretary-Treasurer. Carried.

AUDITORS.

Moved by Mr. Niven, seconded by Mr. Ross, that Captain Gamble be one of the auditors. Carried.

Moved by Mr. Speight, seconded by Mr. Watson, that Mr. Harry Browne be one of the auditors for the coming year. Carried.

MEMBERS OF COUNCIL.

The following are nominated as members of the Council: Messrs. W. F. Van Buskirk, A. J. Van Nostrand, E. T. Wilkie, W. R. Aylesworth, J. W. Tyrrell, H. H. Gibson, A. S. Code, and John McAree.

SCRUTINEERS.

The following gentlemen are appointed as scrutineers for the ballots: Messrs. Speight and Whitson.

It was moved by Mr. Kirkpatrick, seconded by Mr. Dickson, and resolved: "That the sum of $200 be granted to the Secretary-Treasurer as a slight remuneration for his services. Carried.

Moved by Mr. Niven, and seconded by Mr. P. S. Gibson, and resolved: "That we have learned with regret of the removal by death of Jos. Green Kirk since our last meeting of members." Carried.

Moved by Mr. H. H. Gibson, seconded by Mr. Dickson, that any omissions or clerical errors in the records of this meeting, now in the hands of the Acting Secretary and Stenographer, be corrected by the Committee on Publication before being printed. Carried.

Moved by Mr. Kirkpatrick, seconded by Mr. Wilkie, that the auditors be paid the sum of $5 each for their work auditing the accounts of the past year. Carried.

Moved by Mr. P. S. Gibson, and seconded by Mr. Wilkie, that the President do leave the chair, and that a hearty vote of thanks be tendered to our retiring President for the very able and efficient manner in which he has discharged the onerous duties devolving upon him.

Mr. Bowman thanked the members of the Association for their hearty vote of thanks, and expressed the great pride it had been to him to fill the office of President, and expressed the hope that as years go on all the members will be able to gather annually, and help each other along in the work necessary to keep us abreast of the times in our profession.

On motion of Mr. Dickson, seconded by Mr. P. G. Gibson, at 4 o'clock p.m. the meeting adjourned with the singing of the National Anthem.

MEMBERS IN ATTENDANCE AT THE EIGHTH ANNUAL MEETING.

27TH, 28TH FEBRUARY AND 1ST MARCH, 1900.

W. R. Aylsworth.
H. J. Bowman.
E. D. Bolton.
L. Bolton.
G. L. Brown.
E. Bazett.
M. J. Butler.
J. P. B. Casgrain.
A. W. Campbell.
J. Dickson.
John Davis.
H. L. Esten.
R. P. Fairbairn.
T. Fawcett.
W. B. Ford.
K. Gamble.
H. H. Gibson.
P. S. Gibson.
J. Galbraith.
J. Hutcheon.
G. B. Kirkpatrick.
W. A. MacLean.
C. J. Murphy.
J. J. Mackay.
A. Niven.
Geo. Ross.
John Roger.
F. J. Robinson.
T. B. Speight.
J. H. Shaw.
L. B. Stewart.
V. Sankey.
Angus Smith.
Wm. Spry.
Henry Smith.
H. DeQ. Sewell.
G. E. Silvester.
C. Unwin.
A. J. VanNostrand.
W. F. VanBuskirk.
E. T. Wilkie.
J. F. Whitson.
A. P. Walker.
M. B. Weekes.
J. N. Wallace.

RESULT OF ELECTIONS FOR 1900-1901.

President	George Ross	(by acclamation).
Vice-President	James Dickson	(by acclamation).
Secretary-Treasurer	Villiers Sankey	(by acclamation).

Members of the council of Management elected for the ensuing three years :

A. J. Van Nostrand. J. W. Tyrrell.

Auditors for the ensuing year : (by acclamation).

Harry J. Browne. Killaly Gamble.

I hereby declare the above named officers elected.

VILLIERS SANKEY,
Secretary-Treasurer.

Certified correct.

T. B. SPEIGHT,
J. F. WHITSON, *Scrutineers of Ballots.*

Under Sec. 16. Chap. 180, R.S.O., 1897 the Council appointed Mr. John McAree to fill the vacancy caused by the resignation of Mr. Jas. Dickson as member of the Council.—*Secretary.*

PRESIDENT'S ADDRESS.

Gentlemen,—It is very gratifying to find that a good programme has again been prepared for our Annual Meeting, the fifteenth in the history of the Association and the eighth since incorporation. It is to be hoped there will be time for full discussion of the different reports and papers. A tendency towards a smaller number of papers need not be feared, as in that event more time may be devoted to the consideration of them and the exchange of experiences between the members, which is often more helpful than the papers themselves.

No doubt many of you have noted with interest the propositions of the new leader of the Ontario Government, particularly in reference to the appropriation of $40,000 or $50,000 for preliminary exploration work in the northern part of the Province up to the shores of Hudson Bay for the purpose of obtaining information as to its timber, mines and arable lands; and also his announcement that it is hoped a system may be projected whereby the three million acres of swamp lands in the

Province may be properly drained. A great aid to this latter project would be the carrying out of the much-needed topographical survey of the older part of the Province. In the old County of Waterloo there is a township that has several very large swamps or marshes in it, one of them about a thousand acres in extent, and steps would doubtless have been taken long ago to drain them were there maps in existence showing the topography of the district, the location and elevation of the different ponds, streams and ridges. As a matter of fact there is no plan on file anywhere showing even the lots as originally surveyed in this particular township. As most of these large swamps in this township have no natural outlet, nothing can be done in the way of drainage till a topographical survey is made.

Recently an agitation has arisen for provincial aid for highway construction. As subsidies have long been given to railways, there cannot be any difference in principle in granting aid to establish good macadamized roads as feeders to these railways; and, as provincial subsidies are now very seldom granted to railways in the older part of the Province, it would seem only fair that some plan should be devised for thus continuing the development of the country. In the State of Massachusetts, where the principle of State aid has been adopted, the writer was recently informed by one of the Commissioners that already the large sum of $2,600,000 has been expended in building first-class macadam roads.

A few of our members, who are also members of the Canadian Society of Civil Engineers, accompanied the excursion a month ago to Boston. The experience gained on a trip of this kind, the pleasant intercourse with the other members of the party, and the consequent broadening of the individual thought, suggest the consideration of the advisability of a somewhat similar excursion at some future date for the benefit of our own members. No doubt the members resident at or near our national capital, as well as some of our other larger cities, would be glad to have the Association visit them, and would prepare papers dealing with local matters of general interest.

The proposed Engineers' Bill was amended last year to meet the views of your Committee appointed in that behalf, but it is not likely that it will come up at this Session of the Legislature.

As the Association has now an unquestioned surplus, would it not be well to authorize the Council to purchase for active members 50 or 100 feet steel standards of measurement, and have them stamped by the Dominion authorities. For such a large number a close figure would be quoted by the different manufacturers. Some of our funds could advantageously be used in enlarging and fitting up the new repository. By the use of Luxfer prisms the light could be much improved, and by removing some of the partitions and putting in a wooden floor on top of the concrete a room would be obtained more suitable for the meetings of this august body.

In conclusion, it will be only necessary to make a passing reference to the war now being waged in that distant part of the great empire, of which we are proud to form another part. This unhappy occurrence has shown to the world the great bond of unity which exists between Great Britain and her colonies, as evidenced by the spontaneity with which the people of the colonies have, unsolicited, sent their sons to help the Mother Country in giving to the people of South Africa that freedom which we enjoy. It will be for you to decide whether a fitting donation shall be made to the fund established for the relief of those dependent upon our brave boys who have fallen at the front.

HERBERT J. BOWMAN,
President.

February 27, 1900.

DISCUSSION.

Mr. President—I shall be glad if the gentlemen present will discuss some of the propositions that I have made.

Mr. Sankey—Mr. President, I was going to remark on hearing your address there was so much in it to discuss that it would be well for the different points to be taken up separately and discussed. In some Associations, I believe, it is the custom to refer an address of this kind to a special committee in order to promote a general discussion; but as that would be rather out of the way here I would suggest that each point be taken up in its order as mentioned in the address, and discussed to a finish.

Mr. Dickson—Would you read the address clause by clause?

The President—The new leader of the Government, Mr. Ross, in a speech which, I think, he made at Whitby, mentioned that he intended to ask for $40,000 or $50,000 for exploration work in the northern part of the province. I think that was referred to before in one of the other reports. Perhaps some of our members are in the confidence of the Government.

Mr. Dickson—Perhaps Mr. Kirkpatrick would not mind letting us know what the system is, under which this will be done, if he is at liberty to do so; his information would be of interest.

The President—It was not clear whether this was to be all spent in one year or not.

Mr. Sankey—Assume the money is going to be spent, and let us have the various opinions as to the best way to spend it.

Mr. Dickson—I think if the Government is asking for this grant their intention is to spend it this year.

Mr. Sankey—Are they going to ask our advice?

Mr. P. S. Gibson—They will no doubt ask our advice as to the spending of it.

The President—It is taken for granted that the exploration would have to be made by Ontario land surveyors.

Mr. P. S. Gibson—Of what character is this exploration work to be—for mining or agricultural purposes?

The President—They wish to find out the nature of the country. I should not think they refer to timber.

Mr. Sankey—Both Mr. Niven and Mr. Speight have more experience in our northern country than any one else, and they should know what is the best method of spending the money; that is, getting the most value for the money spent.

Mr. Niven—Well, Mr. President and gentlemen, I do not usually suggest anything; I do what I am told to do. Of course, I have heard something of the exploration, but I have no idea as to what way they intend to do it. I have not given the matter sufficient thought to suggest to-day before this body of surveyors or anyone else what should be done. But I believe that a system of exploration could only be properly conducted between base and meridian lines; and it would be necessary to cut the country up to some extent into certain sized districts, and then the exploration could be made between the district boundaries, because if you send a number of surveyors or others into a country like ours to go through and tell what is in it, they could never know where they were—they would be lost for the time, and, although they might make calculations about their latitude and longitude they would be very much out.

Mr. P. S. Gibson—Don't you think the compass survey would be very much better than these transit surveys to get over the country?

Mr. Niven—With the transit, of course, it takes longer to do it, but you know what you are doing, and when it is done you have something definite.

Mr. Sankey—But with the expense attendant on the running of the base line, isn't the actual exploring overlooked? That is, the thorough understanding of the country seems to me to be overlooked on account of the expense necessary to run the base line.

Mr. Niven—So it is in the way it has been done, because the surveyor cannot leave the line; he is there attending to his work; but in some instances we have had explorers attached to a party whose business it was to go perhaps six miles on each side. Well, sometimes they would go six miles, but very often they would not go so far; it might happen that they thought they had gone six miles when they were only four miles. But it appears to me that if the country were cut up into districts, and then exploration parties put in to explore from one boundary to the other, that you would certainly get a better idea of the country than in any other way.

Mr. Sankey—With regard to these base lines, is it worth while going to the expense of running an expensive transit line through a country you know nothing about? You may start this transit line from a practically useful point, but the line may lead you you don't know where. Therefore the expensive line is more likely to be run in the wrong place than the right. Would it not be well to lay out the country with compass lines first. As Mr. Niven truly remarks, you may not know exactly where you are, but still I think a general knowledge of the country would be acquired, and then the base lines could be run in useful locations.

Mr. Kirkpatrick—I have had a little experience in this kind of work. I had a plan given to me some years ago by the Government. My method of doing this work is to have not only a surveyor with me, but also two or three young fellows, and when you get on to a real nice country, then you can run your meridian lines or governing lines, and run them well, too.

Mr. Dickson—I think what is worth doing at all is worth doing well. We do not know what is in the country. We can go over it, and find out what is on the surface, but we do not know what is underneath it. The ground may be full of minerals, and we may make our compass surveys and establish certain points, and then the true surveys have to be made where the mineral locations are found, and then whatever is to be done should be done in a very thorough manner. I believe in a line being well staked out and blazed with properly marked posts, and then there is no further expense necessary to pick up your lines. I would certainly suggest properly run meridian lines in every instance.

Mr. Kirkpatrick—Of course, I do not know what the Premier will do; but I was asked some time ago by him to prepare a scheme. Well, the first thing to do is to prepare a map. As far as the Rainy River district is concerned I always had a good deal of trouble in early days to get the Commissioner to authorize the running of base and meridian lines with permanent monuments. They were generally afraid that the expenditure could not be defended in Parliament as readily as money expended in subdividing townships into farm lots. I always maintained, however, that if necessary I would go before any committee and justify such expenditure as the best money that ever was spent in the Province of Ontario. I am not required now to go before any committee—the event has justified the action. The Government have gained, I suppose, $50 for every dollar that was spent in running those base and meridian lines. Now, the consequence is that we had base and meridian lines within reasonable distance of each other by the time they were required. This last year there was very nearly $100,000 taken in through my branch alone by the sale of mining lands. I very much question if the cost of running base and meridian lines was anything like that amount. Now, as regards the newer part of the province; that is, the part lying in the Districts of Algoma and Nipissing. Of course, there is really very little known of that, but sufficient is known to expect that there is a very large extent of arable land, as well as a very large extent of territory covered by spruce, which is now probably the largest extent of spruce on this continent. We know exactly what is being done in the way of pulp manufacturing. And as the land is cleared up it will be found from surveys made by Mr. Niven and others that the soil is suitable for agriculture, probably to a very large extent. Now, my idea is that a combination of base, meridian and exploratory lines can be done every year, and I know that such work will not be thrown away. My idea would be to run a base line through the centre of the known good land. I would also probably explore with cheap compass lines—I do not say that I would necessarily run them north or south, or anything like that; but I would have them go through the spruce swamps. Of course, you all know that the rivers flow into the sea through that country, and there is an enormous number of them to map out the country. As well as I could, I have estimated at what cost I thought this could be done for, but I do not believe systematic knowledge of the country could be obtained quickly, but certainly a good general knowledge can be got. I do not think it will be possible, of course, to arrive all at once at an exhaustive knowledge of what the country contains, but I confidently expect that the expenditure of $40,000 or $50,000 will bring in a large amount of information, which is much required concerning the northern part of the country. I think it will be quite evident to everybody that explorers will have to go with each survey party, also probably a geologist, and perhaps in the thickly-wooded part experts in timber, so as to be able to value and estimate the amount of timber. A great many survey parties have good line-runners, but they may not have much idea of the value of the timber. Of course, it is an expert's work, and I think myself that probably a good timber valuator or estimater accompanying each party will not be money thrown away. We may as well get out of the idea that a surveyor can do everything. In parties like these every man will have to use his brains. Not some kind of a line, but a combination of lines, I think, will bring in a large stock of information; that is what I confidently hope and expect.

The President—There has been an agitation for provincial aid towards higher construction of roads. Last fall there was a convention in Toronto of representatives of different municipalities, at which this matter was very fully discussed; and we may look for some legislation on the subject, as no doubt some system can be put into our road building. In some parts of the province it is not looked upon with very great favor because they have good roads; but the method recommended seems to be to have the counties assume leading highways through the county and improve them, the Government giving a grant to aid them in this direction. This method is pursued in some of the States across the line. As I stated in my address, the State of Massachusetts is in the lead. Under this system of State aid they have spent during the last few years $2,600,000 on good macadam roads. The centre of the road is macadamized.

Mr. Aylesworth—For a width of fifteen feet they are macadamized; then the sides are gravelled and proper ditches made. In my county the county roads are under a superintendent, who has three, four or five gangs of men as may be necessary kept in various parts of the county working during the summer season. We also have a bridge gang. We have over 275 bridges kept up by the county. We spend from $12,000 to $15,000 annually on our bridges. Our bridges are now in first-class condition, and are built of iron or wood.

The President—The next matter I touched upon was the trip of the Canadian Society of Civil Engineers to Boston. About a month ago I suggested the advisability of our Association taking a similar excursion to perhaps Ottawa or some of the other large cities in the province or Montreal Then I mentioned that the Engineers' Bill was amended to suit our Committee last year, but no progress was made in the Legislature with it. I believe the chairman of the Committee, Mr. Chipman, is at present in Europe, so it is not likely that the matter will come up this Session.

The next matter I suggest is to use some of our surplus in the purchase of steel standards of measurement. We have already got those little wooden affairs which are given to those who pass the final examination. What we need is a reliable standard which we can take into court, as a standard of measurement, and if a couple of hundred were bought at one time it could be done very expeditiously and very cheaply, and no doubt arrangements could be made with the Weights and Measures Department at Ottawa to stamp them all at the same time.

Mr. Sankey—When the present Board of Examiners came into office we found there was about half a gross of the old wooden standards in existence. They were not stamped. Well, we thought that such good old timber as that (I understand good seasoned timber is rather expensive now-a-days), was too good to be thrown away. However, you will be happy to know that the last of those old sticks has gone. We are to-day in communication with the manufacturers as to a suitable standard. The suggestion that the Board of Examiners made was that a thirty-three-foot steel tape line be graduated in feet on one side and links on the other, the first foot to be graduated into inches and sixteenths and the last foot to be graduated into tenths and hundredths, the first ten links to be graduated into individual links, as a suitable standard for Ontario Land Surveyors. Then a sixty-six foot tape or a 100 foot tape could be easily compared with such a standard. One of the strong objections to having a thirty-three foot tape is that it is not very much good to take out in the bush or in the country. Under the Statutes a surveyor is supposed to take the standard supplied him by the Board of Examiners to compare his chains with.

Mr. P. S. Gibson—We are bound to have our chains stamped.

Mr. Sankey—We are bound to be in possession of the standard that is given by the Board of Examiners, and we are supposed to have sufficient knowledge to compare the other chains we use. What I want to know is whether the 33-foot steel tape, which is not of a very expensive character, graduated as I have mentioned, will be in the opinion of all present a suitable standard to have. The candidates for examination, when they pass their final examinations, have hitherto been charged $2 apiece for the wooden standards I have no doubt they would be willing to pay a little extra if they got a better standard. At the present time the funds of the Association might be drawn upon to a certain extent. Surveyors who have been in practice for some time would pay $3.50 or $4 for a tape such as I speak of.

Mr. P. S. Gibson—Mr. Sankey's views meet mine exactly.

The President—I think that a 100-foot tape would be perhaps a more satisfactory standard, because you could compare the 100-foot, 66 foot and 33-foot chains directly with this.

Mr. P. S. Gibson—I would suggest this: that there should be different lengths for standards, and those who want a 100-foot one should pay a little more.

The President—I think every member should have a standard tape, either to be furnished gratis or upon a small payment; a 100-foot tape would be the most satisfactory. A portion of the tape might be divided in the metric system, as some time in the future the metric system may be adopted, and we might just as well have the graduations in these standards ; and if they are properly taken care of they will last forever.

Mr. Sankey—As to price, I am reading now from the Lufkin Rule Company price list. Their price for a 25-foot tape, marked in feet and tenths and hundredths, with a substantial case and everything perfectly suitable for doing actual work, is $4.50. The price for a similar tape 100 feet long is $12.80. The 50-foot tape is $7.20. I have one of these tapes myself, and it is a most beautiful tape. I did not go to the expense of having it nickel-plated, though they nickel-plate them for $1.50 more. I have used it two years, and it has given me great satisfaction. It is a very easily-cleaned tape. The material it is made of is not easily rusted, and it is very easily brightened. It does not kink very quickly. I think the diameter of the box is 3 3-4 or 4 inches.

Mr. P. S. Gibson—What is the breadth of it.

Mr. Sankey—It is probably about five-eighths inch.

The President—Of course, our standards need not be used for measurement, but for comparison. A narrow tape is less apt to be broken by being stepped upon. I should think that by giving a special order for a couple of hundred of 100-foot tapes they could be got for about $5 apiece, and if we got the Dominion Government to obtain them for us we would not have to pay any duty; they could be made in England. Most of the best tapes are made in England, and afterwards sold by our American cousins as their tapes.

Mr. Sankey—I would like to know for the Council and for the Board of Examiners what the Association desires to do in this matter. We may go and buy a 33-foot tape, and no one will want to buy it from us.

Mr. P. S. Gibson—Order a variety of lengths.

Mr. Sankey—That would not answer, Mr. Gibson. Whatever standard is going to be established must be officially established, and every surveyor should be in possession of the official standard.

Mr. Aylesworth—I think it would be much better to have a standard of about 33 feet. I move that this Association recommend a 33-foot standard.

Mr. Ross—I beg to second Mr. Aylesworth's resolution. I think the standard should be of the same material as the tapes we use; the standard will be correct up to a certain temperature.

The President—It has been moved by Mr. Aylesworth, seconded by Mr. Ross, that the Board of Examiners be recommended to adopt a 33-foot steel tape as the standard of measurement to be given in future to those who pass the final examination. They might purchase a sufficient number to allow the older members to get them at a nominal figure. I hope that they will be able to do so.

Mr. Wilkie—For myself I should be very glad to purchase one, and I think with Mr. Sankey that the 33-foot would be the most suitable. I do not anticipate any trouble in comparing the length of my 100-foot chain with the 33-foot standard.

The President—Probably the Council will issue a special circular after they ascertain what the cost of the different lengths would be, and after they find out about testing by the Weights and Measures Department, and then find out how many would be required. The motion was carried.

The President—The only other matter I mentioned was with reference to the war that is now being waged in South Africa, to draw your attention to the fact that it would be a very good idea, I think, to make a small grant towards the Patriotic Fund. I would suggest that we give $100. We have practically a cash balance on hand of $2,000, so that we do not have to consider very long whether we can stand a small grant or not.

Mr. Dickson—I think we can stand it very well.

Mr. Van Nostrand—We have one or two accounts that will be due. I do not know what the printing of our manual will be—it was to be here to-day, but it has not arrived yet—but that will be a fairly large item. Then we have the standards to consider, and the new rooms that we are about to have given to us on the other side of the corridor will be partially fitted up by the Government for our use; but it was intended that we should have some elaborate fittings of our own, which would run into a certain amount of money. The surplus last year increased about $300; in the previous year there was scarcely any increase; it is not a regular increment at all, and last year's record was considerably out of the ordinary. Part of it was due to the fact that moneys due to the Association had not been collected the year before, and they came in last year, so that we cannot look for any similar experience. I do not think that an average of more than $100 a year can be counted on, with our present running expenses, for increasing our surplus. It has been suggested that when the surplus got large enough we should carry on any litigation which we may be brought into in view of some matters that are now before the Council; it was proposed also that after our surplus had come to a substantial sum the annual dues would be reduced to $1. There are members who think $4 too much. Proposed by Mr. Aylesworth and seconded by Mr. Dickson, that $100 be given to the Patriotic Fund. Motion carried.

The President—I would suggest that the cheque be made payable to Sir Oliver Mowat. He is the President for Ontario, and it would be very nice to have his autograph on the back of our cheque, and probably in the future it would be a relic that we would prize.

The President—Mr. Blue, of the Bureau of Mines, has just conveyed to me the intelligence that the Commissioner of Crown Lands would be glad if we would take an upper chamber and go up higher. We can have the use of the Railway Committee Room for the rest of the afternoon.

REPORT OF THE COUNCIL OF MANAGEMENT FOR THE YEAR 1899.

Mr. President,—The Council held its regular meetings as laid down in the Statutes. At the first meeting (the late Mr. Foster, then a member of Council, having been elected vice-president), the Council under the authority of the Statute appointed Mr. James Dickson on the Council for the remainder of Mr. Foster's term. During the last meeting of the Council Mr. George Ross was appointed to the position of vice-president for the remainder of this year, owing to the untimely death of Mr. Foster. The Council reports with sorrow his loss. His services on our Executive were of great assistance, and it was with pleasure that we were looking forward to his assuming the duties of president, which no doubt would have fallen to him at this meeting.

During the year the By-laws have been revised, and I now present a copy for official ratification by the Association. They number from 1 to 46. I also present a copy of the Rules of our Examinations to be ratified.

Referring to the recommendation published in the annual report with regard to the legislation which we settled upon at the last meeting in respect of amendments in the Registry Act, our deputation was referred by the Government to Mr. Guthrie, inspector of Registry Offices, who gave us a most attentive and courteous interview, which resulted in the amendments as passed last year. While in some details our proposals were not entirely carried out, all the important points were accepted almost in our own words.

I hoped, gentlemen, to have had the copies of the Manual here to present them, but we have just heard from the printers through some unfortunate delay in the binding they will not be here until to-morrow morning. The preparation of this Manual required considerable care not so much in respect to what should be put in it as to what should be left out, the first consideration being its portability, it being primarily intended for use in the field and for ready reference in the office. Perhaps some may say that some sections of certain Acts or a synopsis of them should have been inserted; for instance, those sections of the Municipal Act relating to roads and highways, their widths and the acceptance of them, etc. There are a great number of sections and sub-sections in the Municipal Act which refer to this branch of the Municipal Act. We did not put them in the Manual because they do not directly concern the surveyor in the field. Reference is made to them, however, so that a surveyor can readily turn up what in the Municipal Act refers to roads. Certain sections in the Railway Act as to the duties of arbitrators were not put in for the same reason. The answer generally to an objection such as this is that we should have had to put all in; a synopsis alone would have done more harm than good. It is apt to lead astray, and it is better to let the surveyor read all the sections of every Act relating to roads.

Amongst the suggestions made by us as to part of the Registry Act, which were not adopted, was a proposed form of certificate for compiled plans. As you may remember, there is a difference of opinion as to what certificate should be used, some thinking that the proper certificate to be put on a compiled plan is the one which is already in the Act, Schedule O, Section 100. But if you will look at Section 100 of the Act you will see that the only plans upon which this certificate has to go is where any land is surveyed for the purpose of being resold, or conveyed in lots by reference to a plan which has not been already registered. That is the only kind of plan upon which the particular certificate in the Act is required. If you turn to the section which refers to the preparation of and compiling of plans you will notice that two certificates are required. The Act reads as follows: "Each map or plan shall have endorsed thereon the certificate of the clerk and the head of the municipality and the surveyor." Clearly the one—that is, the certificate signed by the clerk and the head of the municipality—is a certificate that the plan was prepared under the direction of the municipality; the surveyor signs a certificate that it was prepared in accordance with the provisions of Section 111 (or, as the case may be) of the Registry Act. Otherwise all the proposals that we suggested have been adopted, and the Act was passed last session. In the Manual that we have prepared we have revised Chapter 136 of the Revised Statutes in accordance with the provisions of that Act. The index has also been carefully compiled and considerable information in addition to the special Acts relating to surveys and other Acts that have reference to surveyors and their duties has also been added. It is, therefore, hoped that surveyors will not have much trouble in turning up and finding out what may be required of them under the whole limits of the Ontario Statutes.

The Council has also to report that after an interview with the Commissioner of Crown Lands he has given us the use of the rooms opposite the ones we now occupy; and as these are for ourselves only it would be proper for us to spend some money to equip them in a suitable manner in addition to what the Government may feel able to do for us.

Respectfully submitted,
VILLIERS SANKEY,
Chairman of Council.

DISCUSSION.

Mr. Sankey—I think with regard to the By-laws, gentlemen, that a special motion to adopt them as printed in this annual report is necessary, and we will have the official seal of the Association put upon them and filed away; in fact, I think the best thing to do is to bind them into a book. We have the By-laws here numbered from 1 to 46, and have them published in the annual report; also the rules of the Board of Examiners.

Mr. Dickson—I beg to move the adoption of these matters, and also the adoption of this report.

Mr. Watson—I second that motion.

Mr. Sankey—I beg to move that the report of the Council be adopted.

Mr. Niven—I second that motion.

Mr. Aylesworth—Is it in the conditions of the Registry Act that you are not to use pen and ink in copying books or plans in these offices?

Mr. Sankey—I am not aware of that in the Registry Act itself. I have seen in the Registry Office a notice in the book that no pen and ink is to be used on the books.

Mr. Aylesworth—And some Registrars say that we have no right now to take copies without charge.

Mr. Sankey—I will not say it is not in the Act.

Mr. Aylesworth—I think you will find it in the Registry Act. I do not think that restriction came from this board.

Mr. Sankey—It is new to me.

Mr. P. S. Gibson—Although that is found in the Registry Act there is no penalty.

Mr. Aylesworth—But you cannot do it if the Registry Act says it is not to be done?

Mr. Gibson—No.

The President—If that provision has been inserted in the Registry Act we certainly should take some means to have it remedied. My idea has always been that surveyors should be entitled to look at any plan in the Registry Office free of charge. Surveyors ought to have all the information they can get and not be limited by having to pay for every little thing they want to look at, and perhaps not have to use it at all. Registrars in a great many counties get more in the way of fees than they ought to get in return for the work they do, and a provision of that kind would be a great benefit to the country at large. I do not think any surveyor would abuse the privilege of looking up plans; in fact, I think in some of the Registry Offices surveyors are allowed to look at any of the plans without charge. There is a striking contrast to the methods pursued in the United States. Last fall I was in the Registry Office in the City of Brooklyn (Queen's County Registry Office). There, there is no charge to the public for making any search; all the plans received in the Registry Office are copied immediately in books, and the original plans are filed away, and the books, properly indexed, are free to the public, to surveyors and to others to come in and get all the information they can get to make a survey properly. And in the same way the deeds and mortgages are there for those who wish to search them to do so, and return the books with the copies to their proper place; and the system seemed to work perfectly. We are certainly very much behind the times here in this way of tying up information that ought to be free under proper restrictions.

Mr. Van Buskirk—I think the Registrars are very lax in carrying out the law in regard to having proper plans made; and it might be a good thing for all of us if we could bring some pressure to bear upon them to have their plans put in proper shape. Take, for instance, the plans of towns. A great many of the towns are not up to date by any means, and the unregistered plans of the towns are of no use on that account; and I understand it to be the duty of the Registrar to demand proper plans from the towns and municipalities.

Mr. Sankey—I think in answer to that remark that all we need to do is to write the inspector of Registry Offices, and he has power under the Act to order every plan over ten years old to be brought up to date. He has power to do what, in his opinion, is right, if the complaint is well founded.

The President—It seems to me that if something were done to adopt the system pursued in the United States—in some of the States at least—to file away the original plans, and keep them so that they will not become worn out, and make tracings, and have them properly mounted in books, that would really be a great saving to the country. Now, in these copies that are shown to the public they are all made on a uniform scale, no matter what the scale of the original plan is, and they date away back to 1800, and before that they have all been plotted on a uniform scale, that is, 100 feet to the inch; and all information is free to the public. Even if they are not made free, if the old fee system is continued, it should be adopted that the original plans are filed away, and not mauled around and destroyed the way they are now. You go into some of the Registry Offices, and they hand you out a roll. About half the package is damaged on top, and you have got to guess at the name. Now, if those original plans were filed away, probably they would not have to be looked at once a year, but the copies might be made on good, serviceable linen, and mounted in books.

Mr. P. S. Gibson—What size would these books be?

The President—Most of the books were in portfolios, about two feet by three. In other cases they had them rolled up; they had files, looking something like the end of a boiler, with a covering over each tube, and the plan was rolled up in that tube; and you look at your index, go to the number of the tube and get the plan.

REPORT OF THE BOARD OF EXAMINERS.

The following, gentlemen, is the report of the Board of Examiners:

The Board of Examiners met at the office of the Hon. the Commissioner of Crown Lands on Monday, February 12th, and following days as provided by statute. The following candidates passed the required examinations:

PRELIMINARY.

Clarke, Leonard, Oswald, London.

FINAL.

Stull, William Walter, B.A.Sc. (Toronto), Sudbury.
Fairchild, William Howard, Simcoe.
Shaw, John Henry, Grad. S.P.S., Pembroke.
Weekes, Melville Bell, B.A.Sc. (Toronto), Brantford.

The successful candidates for final examination were duly sworn and admitted to practice.

BONDS APPROVED AND FILED.

Reinhardt, Carl.
Carpenter, Henry Stanley.
MacKay, James John.

At the above examination the marks as revised were adopted, and were found to be satisfactory to the Board.

Articles have been filed by the following pupils with the following masters, etc.:

ARTICLES FILED (BETWEEN FEBRUARY 1899 AND FEBRUARY 1900.)

NAME OF PUPIL.	NAME OF SURVEYOR.	RESIDENCE.	DATE OF ARTICLES.	TERMS.
Beaton, Wm. A.	Moore & Henry	London	Feb. 17, 1899	Three years
Stull, W. W., B A Sc. (Toronto)	DeMorest & Silvester.	Sudbury	Feb. 13, 1899	One year
Fillmore, Stanley H.	James A. Bell	St. Thomas	Feb 20, 1899	Three years
Robinson, A. H. A., Grad. S.P.S.	L. V. Rorke	Sudbury	June 1, 1899	One year
Paterson, Herbert	C. F. Miles	Rat Portage	Aug. 1, 1899	Three years
Benson, Robt. Lane	V. M. Roberts	St. Catharines	Jan. 2, 1900.	Three years

VILLIERS SANKEY,
Chairman of Board.

REPORT OF THE SECRETARY-TREASURER.

Mr. Chairman,—I beg leave to submit the following Report of the official business of the Association transacted in my department between 28th February, 1899, and 27th February, 1900:

The following circulars were issued:

No. 48	Ballot for 1899-00	225	Copies.
" 49	Explanation of ballot with names of candidates	225	"
" 50	*Re* Canadian Society of Civil Engineers' Ontario Bill	225	"
" 51	Announcement of annual meeting for 1900	275	"
" 52	Request for return of copies of Survey Act	225	"
" 53	Programme for annual meeting, 1900	400	"
" 54	*Re* Change of date for Annual Dinner	250	"
Letters, post-cards and accounts sent			960
Letters and post-cards received			510
Copies of Exchanges sent to members			800
Copies of Proceedings shipped to Exchanges			470
Copies of Proceedings sent to members			227

Copies of the 1899 issue of Reports from the Engineering Society of the School of Practical Science, Michigan Engineering Society, Illinois Society of Engineers and Surveyors, Indiana Engineering Society and Iowa Civil Engineers' and Surveyors' Society have been sent to all members not in arrears for the current Association year.

The Proceedings of Ohio Society of Engineers and Surveyors for 1898 and 1899, Wisconsin Engineering Society for 1898 and 1899, and the Purdue Society of Civil Engineers for 1899 have not yet been received, nor have our Reports for 1899 been forwarded to these societies.

During the past year six new members have been enrolled, of which number four were admitted by the Board of Examiners at its recent session, and one withdrawn member has re-registered. Six active members have withdrawn their names from the list of practitioners, and death has removed Messrs. Jos. Kirk, F. H. Lynch-Staunton, James Hales Reid and F. L. Foster. The register now stands as follows: Active members, 227; withdrawn members, 60; dead, 28, a total enrolment of 315 members since the incorporation of the Association in April, 1892.

The attention of the members is drawn to the work each year being done by the various standing and special committees. Each has important duties, the details of which amount to much more than can be seen by a perusal of the reports. The Land Surveying Committee serves as an advisory council to some of our members, who, owing to their remoteness from Toronto, are unable to attend the meetings, and the interchange of ideas resulting from the knotty problems submitted form an important addition to the value of association. The papers secured by the Drainage and Engineering Committees are carefully read by members interested in these branches of practice.

The Committee on Topographical Survey has been working away with the object of arousing the powers that be to a recognition of the fact that our fair Dominion is away behind the age in that essential, and that Committee should have the credit due it when, in the future, a triangulation survey is inaugurated. We have, from time to time, had able reports from the Exploration Committee, whose advice in carrying out the new policy of the Government may be found valuable. Upon the Publication Committee falls much of the drudgery of the Association, but it has always been performed cheerfully and as promptly as the many exigencies permit. The labors of the Entertainment Committees speak for themselves in the constant improvement in the method of conducting our annual recreation.

Work in the Repository and Biography Committee has been delayed for the past few months pending the fitting out of our new quarters, when it is expected that it will be prosecuted with renewed vigor.

The appended financial statement shows that the Association is now on a substantial basis in that respect; and I am glad to be able to report that the number of members in arrears is growing smaller. In the majority of cases those in arrears have the best of excuses, which the increased demand for the services of our profession will doubtless soon remove.

Another point upon which the Association is to be congratulated is the spread of active interest evinced by its members. Our oldest professional representative, who has been a duly authorized land surveyor for more than sixty-one years, has this year prepared a paper for the meeting, and already more than a dozen members have signified their intention of contributing to the programme for 1901. A larger percentage than usual of the papers on the programme relate to land surveying proper.

We have to regret the loss sustained by the death of our Vice-President, whose obituary appears in the "Proceedings" for 1899, and of Messrs. Kirk and Lynch-Staunton, to whose efforts our Biographical Section in past years is indebted for much information, which they alone could give.

The thanks of the Association are due to the Carnegie Steel and Iron Co. for a copy of "Carnegie's Pocket Book"; the A. & P. Roberts Co., for a copy of "Steel in Construction"; the editor of "The Surveyor," London, England, for continued donation of that valuable publication; to Mr. A. Kirkwood, for a sufficient number of copies of his translation of a pamphlet on "The Art of Observing" to supply all our members, and to numerous other donors. The Annual Reports of the United States Coast and Geodetic Survey, the Geological Survey of Canada, the Dominion Archives and the Ontario Reports of the Bureau of Mines, and Bureau of Industry and Forestry have been received regularly through the kindness of the officers in charge.

In concluding my tenth Annual Report permit me to thank the members for the uniform courtesy accorded their Secretary, and for the loyalty with which they have supported the Association.

Respectfully submitted,
A. J. VAN NOSTRAND,
Secretary-Treasurer.

STATEMENT OF BALANCES, RECEIPTS AND EXPENDITURES BETWEEN 28TH FEBRUARY, 1899, AND 27TH FEBRUARY, 1900.

DR.

To balance on hand, 28 February, 1899		$1,664 45
" Amount collected for advertisements in 1898 Report	$ 38 00	
" " " " " 1899 "	82 00	
" " " for Proceedings sold	50	
" " " for Certificate	50	
		121 00
" " Registration Fees 6 at $1.00 each	6 00	
" Annual Dues for 1893-4, 2 " 4.00 "	8 00	
" " " " 1894-5, 1¼ " 4.00 "	5 00	
" " " " 1895-6, 1 " 4.00 "	4 00	
" " " " 1896-7, 1 " 4.00 "	4 00	
" " " " 1897-8, 6¼ " 4.00 "	25 00	
" " " " 1898-9, 19 " 4.00 "	76 00	
" " " " 1899-0, 160 " 4.00 "	640 00	
" " " " 1900-1, 9 " 4.00 "	36 00	
" Commuted Arrears 1 " 5.00 "	5 00	
" Associate Fees 3 " 2.00 "	6 00	
		815 00
" Accrued interest on Savings Deposit		41 11
" Receipts in Board of Examiners' account (including Government grant of $200.)		432 00
		$3,073 56

CR.

By amount for Publishing Proceedings of 1899 meeting	$374 30	
" " granted to Secretary-Treasurer for 1898-9	200 00	
" " Paid for postage	58 20	
" " " " Printing and Stationery	52 10	
" " " " Extra Copies 1899, Exchange Reports	39 00	
" " " " Stenographers' Fees reporting Annual Meeting, 1899	35 00	
" " " " Expenses of Members of Council	20 10	
" " " " Binding and mounting	11 85	
" " Granted to Auditors	10 00	
" " Paid for Freight, Express, and Shipping Charges.	7 81	
" " " " Furniture for Repository	3 00	
" " " " Customs Brokerage	2 00	
" " " " Cartage	1 60	
" " " " Bank Commissions	1 35	
" " " " Telegrams	50	
" " " " Office Sundries	25	
		$ 817 06
" " " " Disbursements in Board of Examiner's Account		217 35
" Balance on hand in Savings Bank	$1,403 05	
" " " " in Current Account	636 10	
		2,039 15
		$3,073 56

A. J. VAN NOSTRAND, Secretary-Treasurer.

I have also, gentlemen, to hand you the certificate of the auditors, which reads as follows:

Toronto, Feb. 28, 1900.

We hereby certify that we have examined the accounts of the Secretary-Treasurer, and vouchers therefor, also Financial Statement, and have found them correct.

Respectfully submitted,

A. W. CAMPBELL.
H. L. ESTEN,
Auditors.

REPORT OF COMMITTEE ON REPOSITORY AND BIOGRAPHY.

Mr. President,—Your Committee on Repository and Biography beg leave to report as follows:

The usual reports and exchanges have been received throughout the year, and the collection of technical works in the library is steadily increasing in proportions and value. Owing to the fact that the rooms in the Parliament Buildings at present occupied by the Association are required to meet the demands for space for the Surveys Branch of the Crown Lands Department, it has been found necessary to seek other quarters. We have been fortunate enough to secure the consent of the Honorable the Commissioner of Crown Lands to our transfer to a suite of three rooms on the opposite side of the corridor from those now occupied by the Association.

The Government also, in consideration of the connection of our profession with the Crown Lands Department, have further arranged for fittings for the new rooms to meet the main requirements of the Board of Examiners, but in order to have these rooms made suitable it may be necessary to draw upon the exchequer of the Association for a moderate amount. When all is completed it is confidently expected that a great improvement in every way will result from the change, and that the next annual meeting will find us in quarters much more suitable than heretofore. Your Committee would ask the co-operation of all Ontario land surveyors in the collection of data relating to early surveys and surveyors. Slight reflection is necessary to convince us that the passing of each year seals forever one or more sources of information, and valuable history is thus irretrievably lost to the country. "Let us, then, be up and doing."

Respectfully submitted.

(Signed), WILLIS CHIPMAN,
Chairman.

REPORT OF COMMITTEE ON ENGINEERING.

[Owing to the numerous engagements of the chairman, no meetings of the committee were held, and consequently no report is forthcoming.—Ed.]

REPORT OF COMMITTEE ON TOPOGRAPHICAL SURVEY.

Mr. President,—Your Committee on Topographical Survey beg to report as follows:

That the earnest endeavors made for these many years for the inception of a trigonometric or geodetic survey of Canada are at last giving hopeful signs for an inauguration thereof.

A question of such intrinsic merit in the development of our country and of our national life can only be benefitted by the fullest public discussion. With that end in view, many separate copies of the Committee's Report of last year were struck off for circulation among our legislators.

Your Committee regret that Canada was not represented at the Seventh International Geographic Congress, held at Berlin last September, as it meets only every five years. At this Congress a map was exhibited, which deserves especial reference. As you are aware, a chain of triangles has been expanded throughout the whole length of Finland ; and now the Finnish Geographical Society has completed a remarkable atlas, shown at Berlin, "in which all the conditions of the land, natural and economic, are mapped with a completeness that has never been attempted for any other country. It even includes a map showing in horse-power the available energy of the rivers." In this, well may we emulate the Grand Duchy of Russia.

Since the last report of your Committee the Report of the Trigonometrical Survey of New South Wales has been received, and is replete with matters of interest. Queensland, too, has its trigonometrical Survey, so has Victoria, South Australia, Western Australia, and even Tasmania inaugurated one fifty years ago. To the splendid geodetic work done in South Africa by Dr. Gill references have been made on former occasions. The premier colony of all, however—an appellation with which we are wont to clothe ourselves—Canada, has no trigonometric or geodetic survey. Until we have such no thorough topographical survey can be instituted nor reliable maps had.

However, there seems reason to believe that there is beginning to be a public awakening to the necessity of initiating this great work, not from scientific reasons, but purely from material reasons, as an essential link in our national progress and the development of our unrivalled resources now lying dormant.

All of which is respectfully submitted.

February 26, 1900.

Otto J. Klotz,
Chairman.

REPORT OF ENTERTAINMENT COMMITTEE, 1900.

Mr. President,—Your Committee on Entertainment for 1899-1900 beg to report as follows:

The question as to whether the Annual Meeting of the Association should be held in the Parliament Buildings or in some hall in the central part of the city was discussed by members of the Association and decided in favor of the former. The thanks of the Committee and the Association are due to the Honorable the Commissioner of Crown Lands for his kindness in securing for us the use of the Railway Committee-room for the more largely attended sessions.

Owing to the second day of the meeting this year falling on Ash Wednesday a change in the date of the annual dinner was deemed advisable, and it accordingly took place on the evening of Tuesday, 27th February, at McConkey's parlors. This date also was rather unfortunate, as several invited guests had already made engagements.

Amongst these were the President of the Canadian Society of Civil Engineers, the President of the Canadian Institute, the Honorable the Commissioner of Crown Lands, the Honorable the Provincial Secretary and Lieut.-Col. Geo. T. Denison.

In addition to the members present were Mr. Aubrey White, Assistant Commissioner of Crown Lands; Mr. Kivas Tully, Consulting Architect for the Department of Public Works; Major Mutton, R. F. Stupart, Meteorological Office; Mr. F. C. Jarvis, Barrister; Messrs. W. S. Skeats, C. M. Canniff, C.E., R. E. Speakman, C.E., and C. Dod.

The chair was taken by yourself, and the vice-chair by the vice-president, Mr. Geo. Ross. Justice having been done to the menu, the toast, " Our Queen," was loyally proposed from the chair, and as loyally received. " Our Empire," proposed by the chairman, was responded to by Major Mutton, and followed by " Soldiers of the Queen," sung by Mr. Canniff. " Our Dominion," proposed by the chairman, was responded to by one of our active members, who has recently been elevated to the Senate. Senator Casgrain, in speaking to this toast, quoted freely from the standard history of Canada in proof of the loyalty of our compatriots in Quebec.

From the vice-chair the toast, " Our Province," was proposed, and it was ably responded to by Mr. Aubrey White. "Our Guests," proposed by the vice-chairman, was responded to by Messrs. Tully, Stupart, Speakman and Jarvis. As volunteer toasts Mr. White proposed the health of Messrs. Kirkpatrick and E. Stewart, and Mr. Niven proposed the health of Mr. W. R. Aylesworth. The toast, " Our Ladies," was responded to by Messrs. Esten, Speight and Skeats. The toast list was further enlivened by the following songs: "The Absent-minded Beggar," by Mr. Canniff; "The Boys of the Old Brigade," by Major Mutton; " Bacon and Greens," by Mr. Niven; " The Extension of the Railway," by Mr. Sewell; " Teddy, the Tyler," by Mr. W. A. Browne, and " Bonnie Dundee,' by Mr. Niven. "Auld Lang Syne " and " God Save the Queen " concluded a very pleaant evening's relaxation.

A detailed report of financial transactions is filed with the Secretary-Treasurer.

All of which is respectfully submitted.

A. J. Van Nostrand,
Acting Chairman.

REPORT OF PUBLICATION COMMITTEE.

Mr. President,—The Committee regret the delay that occurred in publishing the Report. We hope that, notwithstanding a few omissions by the printers, the result of our pleasing labors may not be deemed altogether unsatisfactory. The diagrams accompanying papers are rarely suitable for publication, and a good deal of labor is expended in reproducing them.

The thanks of the Association are due to Mrs. Amy Moss and Mr. Justice Moss for their kindness in giving information regarding the life of Surveyor-General Sullivan for our biographical sketch.

Thirteen hundred and fifty copies of our Report were printed by Messrs. Henderson & Co. at a cost of $374.30.

The members of the Association should not be forgetful of the interests of our advertisers.

We have exchanged Reports with the following societies:

School of Practical Science Engineering Society	200
Michigan Engineering Society	130
Ohio Society of Surveyors and Civil Engineers	100
Illinois Society of Engineers and Surveyors	130
Indiana Engineering Society	75
Iowa Civil Engineers' and Surveyors' Society	70
Wisconsin Engineering Society	20
Purdue Society of Civil Engineers	90
	815

Respectfully submitted.

KILLALY GAMBLE,
Chairman.

REPORT OF EXPLORATION COMMITTEE, 1900.

Mr. President,—In former Reports of your Committee repeated statements have been made as to the desirability of a thorough system for the exploration of our unoccupied territory being adopted. For this purpose as yet no systematic effort has been made. An immense area of our Dominion still remains not only unoccupied, but as to its resources and capabilities of production almost unknown. This almost unlimited field still remains, awaiting the explorer, geologist and surveyor.

It is not many years past when large portions of our territory were spoken of as seas of mountains and wildernesses of rocks, lakes and swamps. What do we now see? These, then, despised, because unexplored districts, the most valuable feeders for our most extensive railway system. All praise to the excellent work done by the staff of the Geological Survey, who, in years past, were our only true explorers! We have the money, and we have the men. Why not devise some systematic method, and press on the work until every square mile of our great inheritance has been reported on and correctly mapped?

There can be no doubt in the minds of the members of the Ontario Land Surveyors' Association as to who the proper men are to undertake this great work. Every year our colleges and O. L. S. Board of Examiners are improving the preparation of our members for just such an undertaking. The lines termed "base lines" and the boundary lines, as lately run, have, we submit, hitherto too closely adhered to the mathematical definition, "length without breadth," to be correctly termed exploration lines. Your Committee would earnestly press upon the Association the necessity of, without any delay, discussing, arranging and submitting to the Government a proposed system of exploration. As to the method to be adopted, many suggestions have been made. That the line of exploration, while being so run as to supply information for a correct plan, should not be confined to a specific direction, but varied in its course at the discretion of the explorer. That at certain intervals of distance lateral explorations shall be made, on both sides of such main line, to the distance of three to ten miles; that where the course of a river can be utilized, its course be sufficiently accurately ascertained, and lateral explorations made in a similar manner as in former case. In case of an extensive survey, supply depots could be established at defined points for convenience of assistant explorers. In all cases we would submit that the modern system of warfare be adopted. Put a qualified and reliable man in charge; do not encircle him with a quantity of "red tape," and give him, as far as reasonable in the case, a free hand.

We leave it in the hands of our comrades of the Topographical Surveying Committee to follow in pressing on that most important, and what is more illustrated every day, absolutely necessary work for every civilized community, the filling in of the details after the reports of the explorers have been recorded.

February 26, 1900.

M. GAVILLER,
Chairman.

REPORT OF COMMITTEE ON LAND SURVEYING.

Mr. President,—Your Committee begs to report that during the past year land surveying business has still continued to increase throughout the Province of Ontario, which is without doubt due to the general growth of prosperity our whole Dominion is now enjoying, and the actions our government are taking in providing for the development of our vast agricultural and mining resources, which were never more prominently set before the eyes of the whole world than they are to-day.

We are also pleased to learn of the united action by all interested, in larger proposals now being brought into consideration by our Government, viz., explorations in the northern parts of our Province for the still further developing of nature's wealth.

Your Committee would urge upon the members of the Association the importance of sending into this Committee, in the form of questions any peculiar cases they may meet with in their practice during the year. The practical information given by the members arising from discussion upon the questions is much appreciated by all, and greatly adds to the value of our Proceedings when printed and sent abroad.

A variety of questions in all branches of our profession would be still more interesting.

Questions in surveying have been sent in to your Committee which with replies have been appended hereto.

All of which is respectfully submitted.

Harold H. Gibson,
Chairman.

February 27, 1900.

QUESTIONS.

A road allowance is shown along the Muskoka River on original plan and field notes, and although never used for public travel it has not been closed or dealt with by council.

A plan of subdivision is filed in 1872, showing lots running to water's edge with no road allowance and lots are conveyed according to this plan, also a subsequent corporation plan duly signed by the officers shows no road allowance.

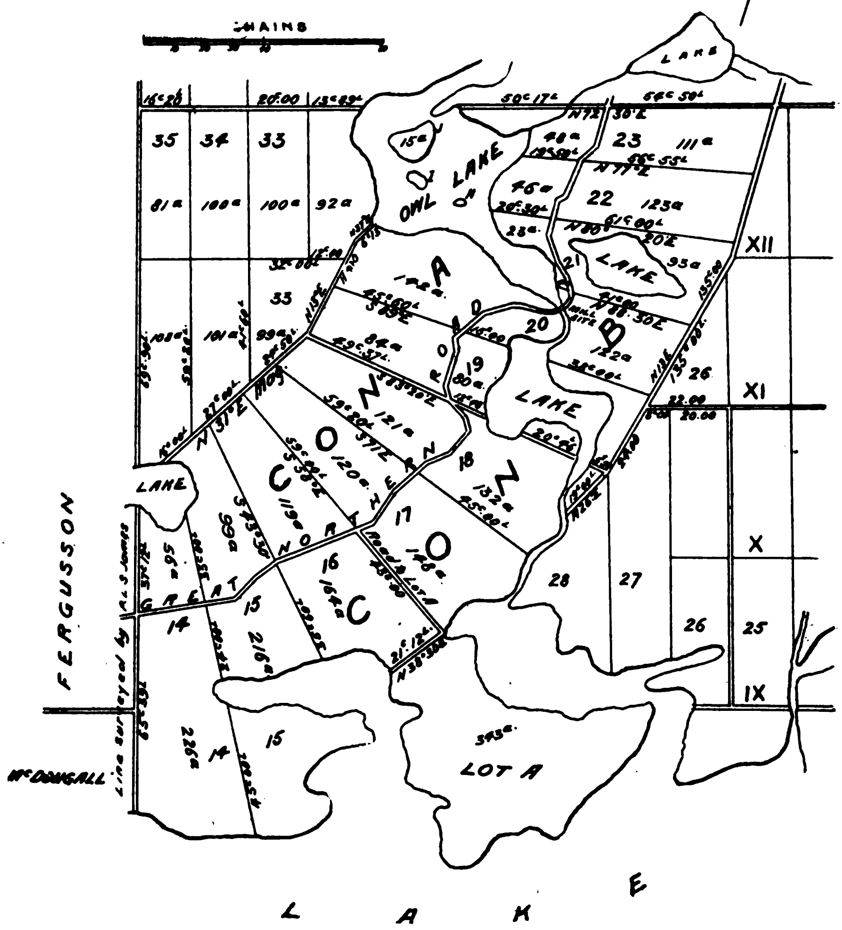
The property is enclosed by a fence excepting along river.

The present council claim this road allowance and instruct their engineer to lay water pipes along it.

Question 1.—Can the engineer and workmen be prosecuted for trespass for entering upon this land. Ans.—No; providing council have passed the necessary by-law for opening the road when it is in the possession of a private party.

PART OF THE

Tp. OF McKELLAR



Question 2.—In making a new corporation plan should this be shown as a road allowance. Ans.—Yes.

The accompanying plan shows part of the Great Northern Road survey through the Township of McKellar. The lots were laid out in the original survey in two concessions, A and B, on either side of the road, being posted along said road on which they front. The posts along the road are all gone from side-road 18 and 19 to side-road 23 and 24. The road is opened and traveled, and runs through a clearing, so that no blazed line can be found, and the points where the various angles were made in the road are not marked on the ground. There are no posts planted on rear line of these road lots (except at the side-roads) as shown by the field notes.

Q.—How would you make sub-division to get point from which to run line between lots 21 and 22, Concession B?

A.—Locate the angles in the road nearest to line between lots 21 and 22 by resurveying the road from nearest known points on each side of same. Between these angles give each frontage its proportional width to that intended in the original survey.

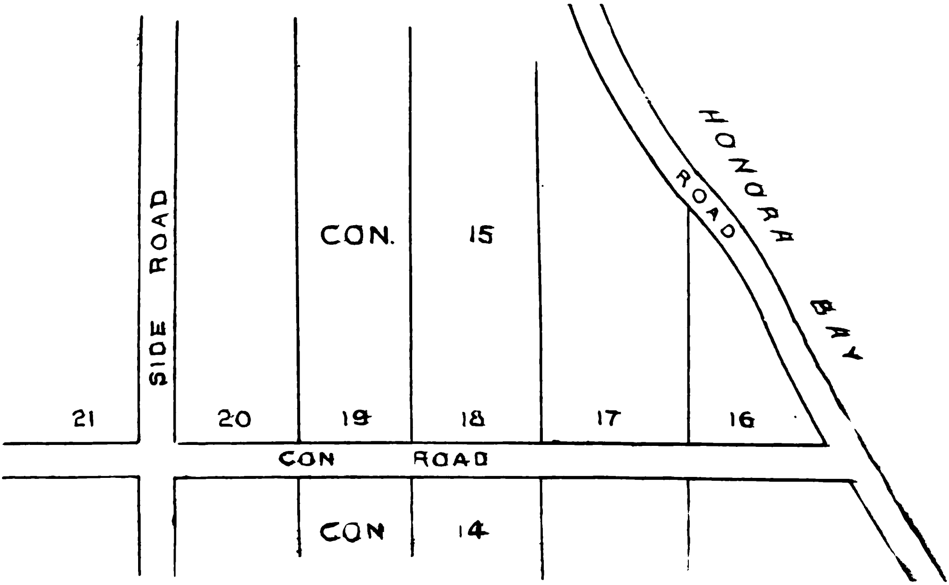
1. What is to be understood by the words, "alternate concession in Sub-section 2 or Section 37? A.—The word "alternate," we believe, was intended for "sectional."

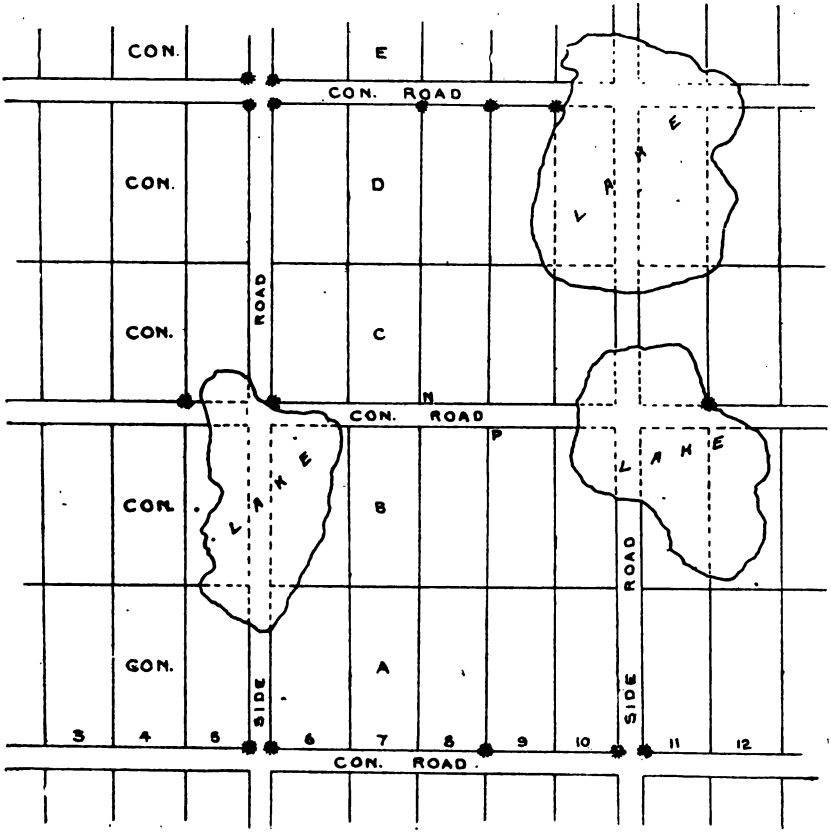
2. Can a municipal survey be made under instructions from the C. L. D. where a concession line is in dispute as to different stakes? A.—No.

3. Where, in an original township survey part of the township was only run out, but many of the lots throughout the whole township were sold, can the Government order the completion of the township survey without a petition from the municipality? A.—No.

If made by the surveyor as a municipal survey under the Act, which Act he does not follow, is his survey legal? Say he made the survey in the year 1854? A.—No.

The next diagram shows a portion of a township laid out in accordance with the order-in-council as mentioned in Section 28, Survey Act, R.S.O., 1897, i.e., in sections or blocks. The governing boundary of the block or section in Con. 15 is broken by Honora Bay. Should the lines from 16 to 20 be run according to the astronomical course as shown in the original notes, or should they be run parallel to line between 20 and 21, which line between 20 and 21 is supposed to have been run in original survey? The township does not come under Subsection 2 of Section 28. A.—Run side lines on same course as line between lots 20 and 21.





Note.—Asterisk (*) denotes where stakes are now standing.

In the above sketch are shown sectional surveys run out after passing of order-in-council of March 27, 1829. See Subsection 1 of Section 28 of Survey Act. The sections are not in townships mentioned in Sub-section 2 or Section 29.

1. Q.—How should line between Lots 8 and 9 in Con. A be run? A.—On same course as sideroad between Lots 5 and 6 as determined by posts at corners of lots 5 and 6, Con. A, and of Lot 6 in Con. C.

2. Q.—How should line between Lots 8 and 9 in Con. B be run? A.—On same course as side-road between Lots 5 and 6 as above stated.

3. Q.—How should line between Lots 8 and 9 in Con. C be run? A.—On same course as side-road between Lots 5 and 6 as determined by post at corner Lot 6, Con. C, and Lots 5 and 6, Con. D.

4. Q.—Should lot lines be shown as on sketch within lake limits. A.—It is not the practice of the Government, but under many circumstances they should be.

5. Q.—How should you find corners N and P? A.—Intersect concession line B and C with side-road 10 and 11, and subdivide from point so found to post at corner, Lot 6, Con. C.

DRAINAGE COMMITTEE.

To the Association of Ontario Land Surveyors:

Gentlemen,—I find it impossible to thoroughly review the drainage work of the Province during the last year, since the labor and expense of collecting statistics in detail is far greater than can be undertaken by members of this Association.

It occurs to me, however, that such statistics might be collected and published without great expense by the Department of Agriculture; and I am satisfied that, in view of the interests involved, the information would be of much value, not only to members of this Association, but to the Province generally.

In so far as I have been able to ascertain, work under both the Drainage Act and the Ditches and Watercourses Act is not falling off, although the sanguine expectations of the public that litigation would be decreased under the revised Acts have not been realized.

There appears to be much dissatisfaction and difficulty in working under some of the recent amendments to the Acts, and it would seem advisable to have some of these matters brought to the attention of the Legislature. I cannot, however, recommend that action be taken by the Association, as I am strongly of opinion that we should interfere as little as possible in matters of this character. It is our business to work under the Acts as they are, and according to the construction put upon them by the courts; and should any member of the Association feel disposed to question the ruling of the county judge or of any other court, it might be well for him, both in his own and his clients' interest, to remember the advice given by "Punch" to those about to be married, "Don't."

The working out of any drainage scheme, and its attendant assessment, is an extremely difficult operation, and requires not only a thorough knowledge of the Acts on drainage, but also a knowledge of the decisions of the various courts. Again, to thoroughly understand and properly apply the dictum of the court, it is necessary to have a knowledge of the particular drain and watershed reported upon before comparison can be made with the case in hand.

There are, however, a few general principles of "judge-made law" which apply to all cases; therefore a study of reported cases will greatly assist an engineer in working out any drainage scheme.

The apportionment of assessment between "benefit," "outlet liability" and "injuring liability" is doubtless the most frequent cause of difficulty. "Benefit" is generally dealt with by the Court of Revision and the county judge; consequently we have few reported cases bearing on this point, and the Association can do good work in collecting such decisions. I have attached to this report the decision on a somewhat peculiar case, which, I trust, may be of interest.

The "outlet" and "injuring" liability question is one upon which many court decisions have been given, but as few important rulings have been made since the reconstruction of the Drainage Act in 1894, we cannot tell whether the courts will or will not hold that the Legislature intended to override the common law rights of landholders.

Mr. Gardiner has contributed an interesting discussion upon the above question, which is submitted herewith. I recommend that the cases of "Metcalf vs. Ekfrid" and "Broughton vs. Grey" be studied in connection with it. In conclusion, I may state that I am of opinion that a study of the common law, in so far as it relates to water and watercourses and the rights of riparian and other landowners, will be of great service in the practice of the drainage engineer.

W. F. VAN BUSKIRK, O.L.S.,
(M. Can. Soc. C.E.)
Chairman Com. on Drainage.

IS A NATURAL WATERCOURSE A SUFFICIENT OUTLET UNDER THE DRAINAGE ACT OF 1894?

The interpretation clause [illegible] of the Municipal Drainage Act explains that "sufficient outlet" shall mean the safe discharge of water at a point where it will do no injury to land and roads," meaning, it is assumed, in the case of artificial channels, a sufficient grade and cross-section to properly carry the water.

The Chief Justice of Ontario, in Stephen vs. McGillivray, 18 A.R., page [illegible], says that:

"The mere ordinary clearing up of the country whereby the water ran off through the natural streams cannot, I think, be a reason for charging that water is caused to flow upon and injure lands lower down, within the apparent intention of the statute."

In Orford vs. Howard, 18 A.R., page 505, Maclennan, J. A., says:

"But when they get to McGregor's Creek they get an outlet, which they have a right to use, and they have no further concern with the water when it has reached that point. I think by the common law it is the right of every landowner to drain his land into any natural watercourse accessible to him."

This would seem to indicate that a natural watercourse was esteemed a sufficient outlet under the law of 1887.

Court of Appeal, Harwich vs. Raleigh. Mr. Justice Maclennan says:

"At the outset it is a somewhat startling proposition to say that the Legislature has enacted that landowners shall be chargeable with large sums, for which there can be no pretence that they have or can receive any benefit. Such legislation could hardly be called by any other name than confiscation, and before we can uphold the judgment of the learned referee we must be very clear that such is the meaning and intention of the language used by the Legislature."

The same authority asserts that the right to use a natural watercourse has been recognized ever since the year 1834.

In Broughton vs. Grey and Elma, the unanimous decision of the Supreme Court was that:

"The Act of 1892, equally as that section in the Act of 1887, applies upon the question of outlet, only to drains properly so called, and does not extend to nor include original watercourses which have been deepened or enlarged. Indeed, the contrary opinion appears to me to be wholly inconsistent with the principle upon which the whole of the legislation upon the subject is founded."

It appears that up to the enactment of 1894 a natural watercourse was regarded as a "sufficient outlet."

The above, it may be said, is "ancient history," but does it not concern us when considering the amendment of 1894. The learned referee, in his judgment, Harwich vs. Raleigh, remarks that:

"If in subsequent laws other powers are given, and other modes of proceeding provided, the natural inference is that such new laws are auxiliary to the old."

Therefore, in an endeavor to determine our duty under the law of 1894, are we not justified in regarding the amendments therein as auxiliary to the old law, and are we not more than justified in having due regard to the expressed opinions of the learned judges in their interpretation of previous legislation as it comes to us in the reported cases?

From this source we find on the authority of Chief Justice Hagarty, Stephen vs. McGillivray, that

"The mere ordinary clearing up of the country whereby the water ran off through the natural streams cannot be a reason for charging that water is caused to flow upon and injure lands lower down."

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Mr. Justice Osler, in his remarks, Harwich vs. Raleigh, expresses the opinion:

"That if the Legislature meant to place such an extraordinary burden upon an upper township as is here sought to be placed by Raleigh upon Harwich, which neither needs, nor is benefited by the proposed works, they would have said so in clear and unmistakeable language."

Does the amendment of 1894 express in clear and unmistakeable language that such was the intention of the Legislature?

Mr. Justice Burton, the dissenting judge in appeal, Orford vs. Howard:

"Did not for a moment assume that parties could be assessed in respect of an outlet for water which naturally flowed into the drain from the upper part of the same watercourse," but he asserts:

"It is a very different matter when water is brought from another part of the upper township, which would never have found its way naturally into the stream."

In Harwich vs. Raleigh the same learned judge remarks that:

"The amendment to Section 590 was made no doubt, in consequence of the division of opinion in this court in the case of Orford vs. Howard."

The conditions under which the division of opinion originated, it is seen, was the bringing of water "from another part of the upper township, which would never have found its way naturally into the stream." The principle laid down by the Chief Justice regarding the ordinary agricultural improvement of the land is unchallenged, and no attempt is made to define or restrict those rights, but authority is sought to enable assessment to be made on lands, the water from which would never have found its way naturally into the stream, nothing that can be construed as confiscation or interference with existing rights, simply an amendment to authorize an assessment in exceptional cases where injustice might be done to the lower lands.

From the similarity of the language used by the learned referee in his comments in the case of Harwich vs. Raleigh to that used in Sub-section 5 of Section 3 of the Act of 1894 there is little room for doubt that this amendment owes its origin to that case; the difficulty he experienced in reaching a conclusion, owing to the exceptional conditions found in the drainage area is thus referred to by the official referee:

"None of the 'creeks' in the present case can be compared with McGregor's Creek in Orford vs. Howard. The water between ridges or banks is called a 'creek'; it then spreads out over low, plain land, and is again collected into a drain.

"They caused more water to flow upon Raleigh than would naturally have flowed there, and they brought water more rapidly upon Raleigh than would naturally have come. The water now complained of has been increased in quantity, and the velocity with which it has come into Raleigh has been increased."

It is also remarked that:

"No doubt there is difficulty in construing Section 590, and it may be that it was not intended to apply to such cases as this."

But the learned referee considered it his duty to sustain the assessment against the higher lands, and the Court of Appeal, on an equal division, sustained the judgment, but this decision is overruled by the Supreme Court, showing that in the opinion of that Court the rights of the individual in a natural watercourse, even when of an exceptional character, had not been changed by the legislation of 1892. It was the exceptional character of the drainage area that occasioned the difficulty found by the official referee in reaching a conclusion. Is it not reasonable, therefore, to assume that the amendment of 1894 was intended to provide for such exceptional conditions; but when, considering the value of the amendment, it appears essential to have regard to the action of the Supreme Court, and also to determine if the language used is so "clear and unmistakeable" as to warrant the conclusion that a radical change in the law was intended. No attempt is made to define the term, "causing water to flow upon and injure," nor to define the lands to be assessed. Directions are given to have regard to the volume of water, and to the speed with which it is caused to flow into the drains. The particular lands liable are still to be determined according to the judgment of the engineer or surveyor, Court of Revision, County Judge or referee; but considering the decision of the Supreme Court, can this amendment be regarded as applying to original watercourses, whereby "the principle upon which the whole of the legislation upon the subject" will be set at naught, and the principle of confiscation introduced.

RE APPEAL CANADA CO. FROM ASSESSMENT UNDER BY-LAW NO. 388, TOWNSHIP OF ELLICE. W. F. VAN BUSKIRK, ENGINEER.

JUDGMENT.

IN THE MATTER of the Appeal of the Canada Company, the owners of Lots numbers 12 in the 11th, 12th and 13th Concessions of the Township of Ellice against the decision of the Court of Revision on the appeal thereto of the said Company from the assessment of the Engineer under By-law No. 388, provisionally passed by the said Township on the 29th March, 1899.

The hearing of the said appeal began before me on the 30th day of May last, when at the request of the Canada Company it was adjourned to take further evidence. Whereupon on Monday, the 19th day of June last, I proceeded to take further evidence, and, having heard all parties, I have come to the conclusion that I ought not to disturb the said assessment. It may be that it is not strictly exact to the extent fixed by the said engineer, but I cannot find any evidence upon which to fix with any satisfaction any other assessment lower than that of the engineer. I certainly think that, from a purely agricultural standpoint, the lands may not be benefitted at all by the supposed drain; but as peat lands the lots are valuable, realizing, in fact, more than lands reasonably fit for agriculture in the neighborhood. Then the question comes, Having a value, are these lands benefited by the proposed drainage? Mr. Dickson, witness for the Company, states that it is necessary to have the peat dry, but that if a dredge be used to scoop up the peat, then drainage by drains is undesirable; but if no dredge is used, without drainage (if very wet) the peat cannot well be secured by manual digging. The latter fact is almost self-evident. I have no evidence that it is the purpose of the vendees of the land to get a dredge; and I do not think the Company would set up that contingency to escape an assessment for a drainage, which is certainly necessary to make accessible their peat lands, except only in the event of one of Mr. Dickson's dredges being used.

Without such artificial means these peat bogs can only be worked by being drained. I don't think I should assume the substitution of artificial means for drainage, more particularly when I have no evidence that such are to be employed.

As to the course of the drain, its direction, and as to all other points raised in opposition to the proposed drain, counsel for the Company practically made an abandonment. I, therefore, dismiss the appeal with costs.

John A. Barron (J.).

4th July, 1899.

PAPERS.

[*This Association is not responsible as a body for the opinions expressed in its Papers by Authors.*]

SAMPLES OF A COUNTRY SURVEYOR'S LIFE.

By HAROLD H. GIBSON.

Surveyors may be divided into three classes: (1) City surveyors, (2) Country surveyors, and (3) those performing Government work. Among the latter class might also be placed all those surveyors who do not permanently reside in some particular locality, but rather follow up their work in various parts of the country, as in the case of surveyors who make a specialty of laying out railroads.

As to the personal advantages of any one of the three over the others there would certainly be decided differences of opinion if a decision were called for. For some of us appear to enjoy sampling the life of each during the year, and, like as in everything else, it is certainly well that all do not attempt to cling to any one class.

The writer in penning this article only hopes to point out some features that appear prominent in the country surveyor's life, although sometimes the same might also be noted in either or both of the other classes as more or less prominent.

In the first place it appears to him that the country surveyor's life is the happy medium. For one reason he has not got too much to do, and for another he escapes the hardships, and at times the privations, respectively, of the members of the other classes, which are both very serious considerations, and should be well weighed before being entered upon.

Now, what is a country surveyor? He is one who lives away from the cities, and may reside in some small town, village, hamlet, or even on a farm in some rural district. And in such a location, if he does not know everybody, everybody knows him, and knows him as the surveyor. Being an educated and professional man, he takes the highest stand in society, and should be known for his probity, sobriety and uprightness in the discharge of his duties.

He possesses horses and carriages as well as a roomy office, well lighted, and fully equipped with all necessary furniture, and surveying and draughting instruments suitable for his particular line of local work.

In very many cases he is looked up to as an adviser or counsellor among the inhabitants of his district, which may encircle many miles of territory. For example, if any important business transaction or commercial enterprise is to be undertaken, often the matter is laid before him for his scientific opinion, upon which great reliance is placed. Reliance, however, depends to a great extent upon the length of time he has resided and carried on his business in that locality and his success therein. As time goes on a surveyor grows mighty in the good habit which the law requires of him, to deal justly in the discharge of his duties. Therefore, the longer he lives the more respected he becomes.

The country surveyor, when he first sets up business, may have very extended ideas as to what his future will be, but as time goes on he will often, if not in all cases, find (that is, if he is depending upon his profession as a livelihood) that he must also engage himself in one or more other lines of business. A prominent late surveyor used to say that "if any surveyor started out with the intention of making a living out of running side lines all his life he had better stop at once and go to farming." This is doubtless a fact with many of our country surveyors, and, perhaps, all would find it to be the case, even in the most favored locality. The demand for country surveying is so small that one can only live contented with the fact that his expenses are also quite low. So, when the young surveyor finds that he must also enter into some other business, he begins to see in real earnest (if it has not come to him before) the great advantages he derives from having in his young student days made a careful study of the Quadrivium sciences, or, better still, to have laid special stress on some particular branch or branches thereof, such as engineering, which additional occupation is so often chosen by our members, and appears to be the natural addendum of our profession.

It might be well to note here that for the above and many other reasons would it not be well for our profession, in order to procure a greater uniformity of knowledge among surveyors, that the elementary subjects upon which engineering is based be introduced in the examinations. At the present time, many who present themselves as candidates have already taken a course at some engineering school, which is decidedly to their advantage, for there is no better foundation upon which an engineer can build than through having the practical knowledge which only a surveyor can acquire.

Not all country surveyors engaged in other lines of business besides their own do so for a livelihood, for some may choose to do so through their love of research in some more extensive field than that of our profession, which is very limited when compared with engineering and many other professions and occupations, which are endless in their possibilities for new ideas.

A country surveyor may be said to derive the advantages of not always being placed in a locality where entertainments of a social character are daily going on, excepting, the writer must admit, at least once a year, when he finds it necessary to visit the Queen City for a few days, and enjoy with his brothers in the profession one very sociable evening. He, therefore, has great opportunities of spending his evenings in his library, storing the limitless reservoirs of his brain with such practical information as he now knows from experience is most profitable for him in his business. In his office library will be found many commercial and scientific papers as well as the best dailies, and by a careful study of them, aside from his regular course of reading of heavier works, he keeps up with the times.

Law being the more important part of a surveyor's reading course, he naturally looks for the best and quickest method of acquiring the true meaning thereof, and he finds that by closely following the discussions in Parliament when the laws are being passed and the various interesting court cases, with the judges' opinions thereon, particularly of those reaching the Court of Appeal, that he can acquire abundance of facts to guide him in the discharge of his duties and place him in honorable positions before men.

Let us now observe some of the features of his surveying work which appear to strike us as most prominent.

ORDERS BY MAIL FOR WORK.

How very indefinite they are sometimes! Let us take a very good example. Here is the copy of a letter asking for surveying to be done at Smith's Corners, thirty miles from his office:

Smith's Corners, Feb. 3, 1899.

Dear Sir,—Could you pleas come and do sum survaying for me. Mr. Brown and his men are cutting trees in my bush and wont stop they tell me I must get a survayor to run the rite line, so pleas come at once.

Yours truly, JOHN SMITH.

Of course, Mr. Smith does not understand the great disadvantage to the surveyor in neglecting to state in his letter between which lots the survey is to be made; also the name of the township and number of concession, more particularly in this case as Smith's Corners adjoins three townships; and he requires the work to be done at once, so no time can be taken to write for particulars; therefore all that can be done is for the surveyor to collect together all the old field notes, plans and astronomic information relating to several of the lots, concessions and base lines in each of the three townships. It is also necessary for him to take along, besides his transit, a large compass to facilitate matters on the ground, if it is found possible to do the work with the compass and chain only ; also various other articles and books, such as calculating tables, testament, small tools for repairs and instruments for draughting ; also a Canadian Almanac, which is always improving for the use of surveyors in their astronomic work.

After having driven to Smith's Corners, or in the vicinity of his destination, it sometimes happens that the surveyor may be misdirected, and he will drive up a long lane, perhaps filled deep with snow, owned by one of Mr. Smith's cousins, two miles, more or less, away from the right place. However, he has gotten used to such troubles as these, and says very little. Indefinite orders is one of the trials of a country surveyor, which his city brother doubtless has a little to do with. Definite instructions by letter from those who understand what is required, and personal interviews by all others, would be a very satisfactory rule if always carried out, but this is impossible always, and so the trial goes on.

The evening before the day of survey is always spent in discussing the proposed work, and determining the best and quickest means to the end. Often the party or parties do not require that the surveyor shall make a survey that might set aside existing fence lines or points not at the present time in dispute, but only that he shall establish certain lines on the assumption that all adjoining are correct. This is what is called a "conventional" survey, and it is just as legal as the survey made according to law, so far as the interested parties are concerned when they agree as to it.

Much time is often spent in locating the proper monuments or boundaries from which to commence the survey, it being the most important part of the work; and after they are all determined the balance of the survey is merely a proper application of geometry and mathematics, combined with such practical experience as the surveyor may have at his disposal for speed in the work.

The running of a trial line through bush or over rough ground for a mile or more is a common occurrence. Suppose the surveyor has to join the front and rear angles of both sides of a lot when such points are already marked with stakes, and he does not know the exact bearing of either line, he will then have to assume a bearing obtained as nearly as possible from his knowledge of the township lines, then run his line, say, one hundred chains, more or less, to the rear of the concession, and measure his error, and also the rear end of the lot; then return over the trial line, laying off the calculated offsets; then measure front of lot, which may be quite different from the rear, make calculation for true bearing of other side of lot, and run same from front to rear. This line should then split the stake in centre if there has been no local attraction, and all other allowances for compass variations have been made as the line is being run.

For rough, quick work the surveyor will always use his compass, which gives miraculous results in experienced hands.

There is a no more fruitful source for variety in descriptions of land than out in the country, for occasionally the surveyor will require to use his highest ingenuity to devise some new method in describing a parcel of land. Owing, of course, to various reasons, but the most frequent cause is that due to the owner wishing the surveyor to spend only one day in making the survey when he should have taken perhaps two; and the result is that the description will be either very indefinite in a few years to come, or else very cumbersome, and at least not as simple as it would be if sufficient time were taken in the first place to make the survey.

If there is anything that is mysterious about surveying in the eyes of the general public it is the fact that surveyors sometimes run lines by the stars. During such surveys you will sometimes hear men in the gang discussing the subject, and as their wonderment finds expression in words the more deeply they seem to become mystified. Now, if the surveyor's assistant happens to be along with him he generally adds a few words at the right moment, which seems to have the same effect upon them that is said to have been caused by an old surveyor who, while running lines with his compass, always used to walk around and around it with strange mutterings upon his lips, causing the onlookers to have a very superstitious belief in the results of his work.

Men sometimes ask the question, "What in the world have the stars got to do with my line fences that you need to spend time in looking at them? And it often takes considerable explanation to show why it is so very necessary in many cases to proceed by that method, for the law requires that the line shall be run on the same astronomic bearing as the base line perhaps several miles away.

Often in running lines through thick bush for a mile and a quarter to join a point at the rear after running for about a mile, or perhaps only half a mile, some or all of the men you have with you will begin to impress upon you, if they can, their belief that you are running away across the lots, and perhaps even suggest that you go back and start over again. Some of these men are often old hunters, who have travelled through and through that bush all their lives, and know every foot of it, they will tell you; and they also know just where this line should be by certain old landmarks, considered as right by all, even if the line was never run by a surveyor before.

It is well to note the distances of these points from your line, and as you near the end you may have several points at various distances from your line. The men, of course, are always the first to reach the end of the line, and at once search about for the corner stake; and if you want them to put down a picket on your line at that point, if it happens to hit it exactly, or even close to it, they will sometimes pull up the picket again and set it very carefully off the line on some other point, as if that was the corner stake. and then wait to hear if you will say: "All right, boys; that's where the corner stake is." And thus they sometimes try to catch you if they can when they have been making such terrible assertions about your line running across the lots, when it has really come out exactly right. It is in just such cases as these that the young surveyor is apt to become confused in his work and make mistakes, but experience soon teaches him to ignore all such talk and quietly attend to his own business. Still, he cannot help but feel a little anxious, if for nothing else than his own comfort, for all surveyors doing such work fully understand the peculiar sensations that arise as they near the end of long lines, and they learn to check very many times with care the angle they lay off with the meridian before commencing to run the line.

Country surveyors should fully understand the immense advantage in having the best of instruments, and in keeping them in perfect adjustment. Before commencing a survey in which there are long lines to be run he should always make a quick trial of the more important adjustments, and be particular to see that all screws work if anything a little on the stiff side, to prevent play between the parts, due to wear, which might not be detected in the ordinary process of adjustment.

Owing to the necessity of carrying instruments in buggies over rough roads sometimes the screws will loosen and cross-wires will shift; and if the surveyor does not note this fact he will, of course, find that his work does not come out as closely as it should. In city surveying the lines are generally short, and lighter transits will do the work quite accurately.

DISCUSSION.

The President—No doubt many of us have had similar experiences to Mr. Gibson in receiving letters from different parties, who want you to go to their place and run their lines without telling you where they are. In the part of the country I come from these letters are sometimes written in a foreign language, which adds a little to the confusion.

Mr. Wilkie—I have listened with a great deal of interest to the paper, and I can say that I have had similar experiences. I had a new one this month through a gentleman who ought to have known very much better, as he hailed from the city of New York. He wrote me, asking me to go prepared bringing all information to survey a lot in a certain township. He mentioned the township, but he did not mention the lot. He was a mining engineer, wishing to have a mining location surveyed.

Mr. Niven—People send word to you to go and run a line without specifying where. Only last week I went over into the County of Hastings; arrived there about nine o'clock in the evening; and I was to run a line the next day. It happened that the line was some distance away, about a mile into the woods, I think; and I had no chance of getting in there that night to get an observation; and the only thing I could do was to run a line in from a line I had previously run, as even if I waited another day the weather might change and be unfavorable for an observation, so I ran a line in from the other line. It turned out just as I expected: the night was not fit for an observation; but I had run my line into the point. Then they wanted to know why I had kept them working all day in order to get to that point—what benefit was it to them. Of course, I had a great deal of trouble in explaining to them, and I do not think I succeeded in removing the difficulty from their minds; but that is one of the trials we have in our practice.

The President—I think Mr. Gibson points out the advisability of surveyors in the country not limiting themselves to running lines, but taking all kinds of engineering work. As time goes on this, no doubt, will be necessary, more particularly in the older parts of the province, for there is a need for engineers in every township in the province where our work is now being done by carpenters and day laborers, and it should be carried out scientifically by men who have been trained to think and judge of such work as bridge building and drainage work, much of which will fall to the Ontario land surveyor in the future.

Mr. Speight—I have great pleasure in moving a vote of thanks to Mr. Gibson for his very interesting paper. I am sure we have all enjoyed it, and he has done well to emphasize the fact that he must conduct his business with probity and propriety if he wishes to be looked upon as doing his work in an ideal way.

Mr. Davis—I have much pleasure in seconding the motion. It has given me a great deal of pleasure to listen to the paper. If it shows anything, it shows that the country surveyor experiences greater difficulties than the city surveyor.

Mr. Gibson—It has been of very great interest to me to write this paper myself, for I think in studying a subject there is nothing better for us to do than to sit down with pen and ink in our hands and write about that subject; and you may write out several copies, but in the end you have got the subject down fine, and you know all about it as far as you feel that you can from your knowledge, of the facts; whereas if you had not written it out, you would just have dim ideas of the subject. I find it a great help to write down what I like to know, and then I feel that I have got it all in a nutshell. And as for surveyors continuing their studies, there are a great many of us who make the mistake of discontinuing our studies after we get through. We should keep on in the work, and in that way we grow stronger in the estimation of those around us as to the opinions that we may give on the different subjects. It is a good thing to keep up with the times in reading the matter contained in scientific papers.

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RAILWAY CURVES.

BY H. STRANGE.

It is proposed to connect two tangents by a curve on a railway survey:

Given the angle of deflection$=2a$; in this case, 84°.

Secant—radius $= b$; in this case, 745 ft.

To find radius and tangent, call radius x, and the nat. tangent of < at centre a; then tangent is ax; $b+x$ is the secant, and is also the hypothenuse of the right angled triangle comprised between secant, tangent and radius.

$(b + x)^2 - x^2 = a^2 x^2$ (Euc. 47) or $b^2 + 2bx + x^2 - x^2 = a^2x^2$; eliminating the two x^2 ($+$ and $-$) it stands $b^2 + 2bx = a^2 x^2$ or $a^2 x^2 - 2bx = b^2$.

To expunge one of the unknown quantities, complete the square by adding to both sides of the equation $\frac{b^2}{a^2}$, which is the square of half the co-efficient of the second term divided by the co-efficient of the first term, and we have—

$$a^2 x^2 - 2bx + \frac{b^2}{a^2} = b^2 + \frac{b^2}{a^2}$$

and by taking the square root of both these equations we have

$$ax - \frac{b}{a} = \sqrt{b^2 + \frac{b^2}{a^2}} \therefore ax = \sqrt{b^2 + \frac{b^2}{a^2}} + \frac{b}{a} \text{ and } x = \frac{\sqrt{b^2 + \frac{b^2}{a^2}} + \frac{b}{a}}{a} \text{ or length of rad.}$$

Formula x or radius is $$\frac{\sqrt{b^2 + \frac{b^2}{a^2}} + \frac{b}{a}}{a}$$

and radius multiplied by tang of angle at centre becomes tangent.

If we put this into figures as an illustration for the benefit of beginners, and carry it out into practice: Suppose < of deflection is 84°; < at centre, which governs all the calculations, is half that, or 42°; and to find length of tangent we must call that nat. tangent of 42°, or in this plan, a. The distance from the apex or junction of the two tangents along the line bisecting the < included between the tangents (in this case call it 745 ft.), where the stake on the curve to be cut, and is supposed to be on favorable ground for a railway, is planted; and it is required to find such point on the tangent from which to start the curve in chords of about 100 ft., of such degree of deflection for each chord that the last deflection which touches the tangent shall run exactly along the tangent without either cutting it or falling short of it. If the formula above is used with these figures, using .9 as the natural tangent of 42°, the tangent will be 1941, and that, divided by .9, is 2157, or radius. To run this curve with the transit we must find the degree of curvature for each chord, and the length of each chord, and that is done in this way: The number of degrees included in this curve is 84°, the < of deflection; and, of course, the length of each degree is found by multiplying twice the radius (1941 × 2) by 3.1416, the complete circle of a diameter of 1. That is, the whole circle is 13552.86, and, as a circle is 360°, this curve is $\frac{84}{360}$ of 13552.86, or 3162. As an engineer's chain is 100 feet, there will be 31 chords of 102 feet each, which will consume the whole 84° of the curve. Therefore, each chord will be a deflection of $\frac{84}{31}$ of a degree, or 2° 42′ 35″ which will be the < of deflection from one chord to the next. This applies to every chord but the first one, which, being a deflection from the tangent, must be only the half of what the others require. A pocket logarithm book should always be carried, or the nat. tang. of < at centre should be looked up at home, and the rest can be worked out in the *veldt*.

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THE MINING OUTLOOK IN WESTERN ONTARIO.

By THOS. R. DEACON.
Resident Director Mikado Gold Mining Co.

Mr. President,—In dealing with the subject named above, before this meeting, I am perhaps going outside the lines of legitimate subjects to be discussed before an Association of Land Surveyors; but, as land surveying itself is becoming a lost art in this part of the world lately, and as I have never yet met a man, no matter what other trade, profession or calling he might pursue, who did not think, at least, that he was quite proficient in the art of mining, no doubt the subject would be considered appropriate anywhere. Two and a half years ago I had the honor to read a paper (a copy of which I present herewith) on the "Mining Industry of Western Ontario" before a convention held at Rat Portage, giving the results of my experience and observations up to that time, and expressing certain hopes for the future. Notwithstanding the many adverse circumstances against which the mining industry has had to contend, and notwithstanding the many foolish and absurd (not to say absolutely dishonest) enterprises that have been set afloat from time to time, I am very pleased to say that very real and substantial progress has been made in the establishment of a great and permanent industry in the district in the recovery and treatment of gold and other ores. I do not think that at any time in the history of the district has the prospect been so bright and the permanency of the industry so well established as at the present time. And this has not been accomplished by the blare of trumpets, nor by the discovery of the myriads of bonanzas which have been reported from week to week, each one greater in assay value and the veins wider and longer and richer than the one recorded the week before, but by the persistent and business-like procedure of seven or eight companies, who, having considered mining as a commercial enterprise, requiring the fulfilment of certain conditions as requisite to success, carefully selected properties upon which the general conditions for a profitable enterprise, based upon both the scientific and commercial requirements, were most nearly obtained, went to work, and by the persistent continuance of systematic work, aided by a liberal expenditure of money, which is necessary in any business, have placed their mines in such a position that they are now yielding good profits and the permanency of the properties established. Each one has had its own peculiar problems worked out, and the general nature and individual characteristics of each carefully studied as the work of development progressed, till the owners have become possessed of the knowledge necessary to enable them to continue their operations, not as an experiment, but as stable enterprises. This is certainly making progress, and I am glad to say that there are at least seven or eight properties to-day in a position to work their mines at a profit with their present equipment, and a considerable number more which are being prepared for the actual work of producing bullion, not to say anything of the several score which are being prepared to work the public on the sale of stock, and who always take care never to arrive at the actual point of practical operations. Strange as it may seem, week after week we see new companies launched to operate on properties, the conditions of which are such as to doom them to failure in the very hour of their birth, and where it is amazing men can be found to supply the money, while at the same time many properties which seem to contain all the conditions essential for success seem going begging for development. The writer is aware of several good properties (in which he is not personally interested) which, in his humble opinion, are perhaps the equal of any properties yet operated, and yet they are lying idle for various reasons, chiefly because they have been handled in such a manner as to preclude the reasonable chances of their being fair investments, and so have remained undeveloped.

If I am asked what are the conditions necessary to success, I could only give my own personal opinion, which would, of course, be the result of my experience and observation, and may or may not be of value.

In the first place, as to the prospect itself. With the exception of one or two cases there has been no example to my knowledge in this district of a property having proved to be a permanent profitable gold-producing mine where the vein has not been in the immediate vicinity of the contact of granite or porphyritic granite with some of the Schistose rocks. It may be right in the contact, it may be closely parallel to it, or it may cut across the contact; but the Sultana, Mikado, Regina, Foley, Golden Star and Hammond Reef are all either in the contact or close to it, and, though one of these mines is not at present running, it is no fault of the mine. I do not say that good veins may or do not exist under different conditions; in fact, I believe the Olive mine is not in a granite contact, but this seems to me to be the condition which gives generally the best promise of success. Having selected such a vein, the next step is to have it examined by a thoroughly good engineer of practical knowledge and experience in the district, and who is not given too much to run into a prodigality of figures as to what is under the ground, but who, by a large number of tests, by panning of skilfully selected samples, and also by assays has thoroughly demonstrated the presence of gold in the ore of a value of not less than $5.50 to $6 per ton. If the vein conforms to these requirements, then the next step is to arrange for the development of the property, either by contract or by placing it under the charge of a careful, competent man of business capacity and practical engineering experience in this district, and prepare to expend not less than $50,000 in sinking, drifting and connecting the levels by raises or winzes, and thoroughly acquiring full knowledge of all the various characteristics of the vein before any mill is built. The reason I say the man should have experience in this district is this: the conditions seem to be peculiar. Many men of undoubted ability and experience in other fields have come here, and some of them have frankly confessed that the conditions were so different from what they were accustomed to that they were all at sea, while others went right ahead on the assumption of mineralogical and geological conditions proving the same here as those they had been accustomed to in other mining regions, and the results were disastrous. They would not be apt to make the same mistakes over again, but it cost a good deal to their companies for their experience. When about two years' ore is provided for, an idea may be formed of how large a mill should be built, and naturally the larger the better, because the cost per ton decreases in the inverse ratio of the stamping capacity, the same number of firemen, engineers, amalgamators, etc., being required practically on a ten-stamp mill as a forty or fifty stamp, while the cost of management and transportation, etc., per ton is increased as the number of stamps are decreased. Until the mine is properly developed it is practically impossible to decide what capacity the mill should have, the nature of the treatment to be given the ore, or even the proper location of the mill, as the majority of the veins do not contain all pay ore, but have a broad, or narrow, as the case may be, band or chute of pay ore running through them, sometimes going down vertically and in other veins in a very flat incline. The position and dip of this ore chute will naturally determine to some extent the location of the mill, so that the cost of tramming will be reduced to a minimum. This, of course, is a question of mining engineering and practical common sense, but the study of the nature of the ore deposits and the becoming acquainted with their peculiar characteristics is a matter necessitating some years of close observation and careful investigation of the various conditions under which pay ore is found to exist, and the best means of obtaining the gold in the form of bullion so as to make the whole operation a successful commercial enterprise. The sum total of information respecting the ores in this district and the best methods of treating has been considerably augmented in the last couple of years, and after heavy expense the general nature of the machinery best adapted for the purpose has pretty well been decided upon; and I am now of the opinion that the industry is permanently established, and that one by one other paying mines will be added to those already in operation ; and this would appear to me to be making solid and substantial progress, and to promise well for the future. The Mikado mine has to-day more and better ore in sight in its stopes and drifts than at any time in its history. The monthly output has now risen to practically one thousand ounces per month, and gradually increasing, with larger ore reserves being opened up, while several of the other large mines are pursuing a policy of development, and exposing large bodies of ore for future use.

Careful and economical operation on right lines and on the right kind of property is as sure to bring success as any other kind of legitimate commercial investment.

DISCUSSION.

Mr. Sewell—Mr. Deacon's paper is a very interesting one. As it is associated with one of the principal mines in that locality, the Mikado mine, what he says would naturally have considerable weight. There are one or two points, however, which, I think, need correction. He says that all the mines which have been turning out satisfactorily are at or near a contact. Now, I have been often over the district, and I know that that is not the case. The Mikado mine is in that position. The Adeline mine is in a similar position, but it is a little bit away; it may be a quarter of a mile away from it. The Foley, on the other hand, is right in intrusive ground. The Golden Star is likewise in the intrusive ground; and the Hammond Reef, another very important property, and perhaps the most promising mine in the country, and which I shall allude to later on in my paper, is nothing more than a Laurentian granite reef, and I might go on and quote quite a number of them which are not actual contact veins. The value of a contact vein is very great ; there is no doubt about that; but still at the same time there are other properties which are equally good. I might say that I think myself that as a general rule the best discoveries so far seem to have occurred near centres of disturbance. You will notice that all those I have quoted are very near places which have been considerably disturbed at some period subsequent to their formation.

Mr. Campbell—I am inclined to think that some of the members have taken advantage of this Association to some extent to advertise themselves by writing upon matters which are not at all of direct interest to, or for the improvement of, the members of this Association; and it appears to me that before publishing these papers it would be well to have them submitted to the censorship of the Secretary, or some individual, who would go over them and have them practically re-edited before they are printed in the Proceedings of the Association. I do not see exactly why we should advertise any one mine here, or why any member should take advantage of his position for that purpose. Statements are being made which are not absolutely correct, and which have to be rectified by members present. No doubt a great deal of this information will get into the Proceedings, and be read by many without knowing what the facts are. We should be very careful in our papers to give only facts, and have all these facts vouched for as nearly as possible, and members should confine themselves to questions which pertain strictly to the business of the profession.

Mr. Dickson—I quite agree with what my friend, Mr. Campbell has said. I think this Association was formed for the purpose of promoting the interests of land surveyors above everything else. For a number of years we have had papers on mining

Now, I do not see what that has to do with the furthering of our profession at all. I quite agree with Mr. Campbell. It looks very much to me as if it were used as a way for advertising those particular mines.

Mr. Van Nostrand—I cannot agree with the sentiments of the last two speakers with regard to this paper in particular. It might be quite true of other papers read here. The charge has been made before, and perhaps justly so. In this case I cannot say that I think that this paper boomed any particular mine. It seems to me that seven or eight well-known mines are mentioned, and given equal prominence. Further than that, the writer of this paper is not the only one that has spoken about mining matters in the Rainy River district, and where the parties discussing it have the knowledge, any errors may be pointed out.

I think, too, with regard to the scope of our papers, if we limit them entirely to the running of side lines, which were spoken of yesterday, we may presently have no papers to publish. In this year's programme the greater number of the papers refer to land surveying, a few of them are on engineering work, which is quite foreign to land surveying; and yet we are very glad to get those papers. We are not considering the profession alone, but we are considering the individual members of the Association, whose practice covers a large area. We have also to consider our exchanges. We send our Reports to our brethren across the border, who are not in as fortunate a position as we are with regard to land surveying, and we think we have been helpful to them in showing that land surveying may be brought to a higher standard than they have. Some of the land surveyors in this city are engineering men in their practice. There are a great many points to be considered in selecting papers for a programme, and so we allow into our programme papers that do not relate directly to land surveying.

With regard to this paper itself, it is open for every member to discuss it; and if any member desires to introduce a resolution setting forth that this paper shall be received and printed in the Proceedings, I think that is the fairest way to get the general opinion; otherwise it is left to one or two comparatively obscure individuals to exercise their censorship.

Mr. Campbell—Do not understand me as criticizing the propriety of the programme. I think the programme is very well prepared. I think we should have a diversity of papers; but I do think that some writers take advantage of the situation, and use their position for the purpose of advertising their business or going outside of the profession in discussing matters.

The President—I think Mr. Campbell did not hear all the paper. The writer gives his opinion on this matter, of good profitable mineral occurring in the contact and away from the contact; and I think he is very fair in what he states, and is not at all booming any one particular mine. He says: "I do not say that good veins may not or do not exist under different conditions ; in fact, I believe the Olive mine is not in a granite contact, but it seems to me to be the vein which gives generally the best promise of success."

I think Mr. Deacon's paper a valuable one, and it is fortunate that we can have a paper from one in his position, one of confidence in a large and profitable mine. It seems to me it carries a great deal more with it than a paper from some one who had only a superficial knowledge of the question. At the same time no doubt there is something in what Mr. Campbell said, that some of our papers in the past have not been as sincere as they ought to have been, although I do not think we have had many cases of violation of the rule, that a paper should be of general interest. But in the future as our Association grows we probably ought to have a committee to revise the papers. I think myself that fewer papers and more discussion would be better for the Association. In the Canadian Society of Civil Engineers a great deal of importance is laid upon the proper discussion of the papers; and we are always hurried in our annual meetings, and there is not sufficient time to discuss the papers, because as a rule we have too many. If we were to have fewer papers and a better discussion we would have a more interesting Report, if that were possible, than we have at present.

Mr. Van Nostrand—Before passing to the next item of business we should acknowledge Mr. Deacon's paper in some way. It is usual to have a motion to receive and have the papers printed. I have much pleasure in moving that Mr. Deacon's paper be received and printed in the Proceedings.

Mr. H. H. Gibson—I have much pleasure in seconding this motion.

The President—I think upon reading the paper all will find that there is nothing unreasonable in it. Carried unanimously.

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BACTERIAL FILTERATION.

By E. G. BARROW.
Hamilton.

Of the various methods or processes devised for the purification of sewage the system of rapid filteration (which utilizes minute organisms or bacteria as agents for the destruction of the impurities in sewage) is fast coming to the front as one of the most effective and economical to operate. The purification of the sewage is brought about by the bacteria contained in the filter beds, which are constructed in such a way as to promote the activities of the bacteria, and provide a home, as it were, in which they can carry on their operations in a more perfect manner than is done in the natural soil.

The advantages claimed for this system of sewage purification are, that only a small amount of land is required compared with a sewage farm, that no expensive machinery is needed for pressing the sludge, and that a very pure effluent is produced, which can with safety be discharged into any stream, river or body of water. In large manufacturing cities it may be found advisable to first subject the sewage to a preliminary precipitation in tanks before sending it forward to the filters, but for ordinary domestic sewage, or that which finds its way into the sewers from dwelling houses, this is not necessary. Bacterial or bacteryolitic filter beds are of two kinds—the coarse and fine—the sewage being first admitted to the coarse or roughing filter, and then passing to one or more fine filters. Both of these beds are necessary for complete purification. The sewage is sometimes admitted at the bottom of the coarse filter, from whence it passes upward, and is then conveyed to the fine beds—in this case two or three inches of water remain on the top of the coarse bed. When this plan is adopted no scum forms on the top of the bed, which is the case when the raw sewage is run on to the top of the filter. The office of the roughing bed is the straining and liquefaction of the sludge and partial purification of the sewage. The aerobic or fine beds are the home of the nitrifying bacteria, and the effluent issues from this, freed from most of the organic impurities in solution, and thoroughly mineralized. Bacterial beds have been constructed of different materials and of various depths. Experience has proved, however, that rough materials, such as coke, coal, cinders, slag, burnt ballast, etc., are the best. Experiments made by passing sewage through glass balls and other smooth bodies demonstrated that very slight purification had been effected. The size of filtering material should be, for the coarse bed, that which will pass through a two-inch ring and be rejected by half-inch screen. For the fine bed, that which will pass a screen of three-eighths or one-quarter inches, and be rejected by one having a mesh of one-sixteenth of an inch. In order to get the best results from these filter beds the sewage should, after it has filled the bed, be allowed at least two hours rest, after which it is allowed to run off and then before the sewage is again permitted to fill the filter a period of from two to three hours aeration must be given, in which the interstices in the filter become thoroughly filled with air.

If the ground at the site of the works is of clay or other impervious material it will not be necessary to use brick or stone walls, and the walls or sides can be made of earth thrown up from the excavation—the bottom of the filter beds, however, will have to be above the nearest stream or body of water into which they are intended to discharge. There is no necessity to use tile drains for the bottom of the fine filter beds as coarse material will do just as well, such as broken stone or coarse gravel, and I think several small discharge pipes through the sides are preferable to one large one. The admission and discharge of the sewage may be regulated by machinery working automatically, but my opinion is that an intelligent man to oversee these operations is more desirable. One cubic yard of filtering material should be provided for every eighty-five gallons of sewage delivered in twenty-four hours. This is at the rate of about 400,000 gallons per acre where the filter is three feet deep. If the filter is increased in depth this area may be reduced. Thus if the filter be made four to six feet deep the rate of filteration can be at the rate of 600,000 gallons per acre. It is necessary to have two or more filtering beds so as to permit of the filling, resting, emptying and aerating processes. For a small plant and where economy has to be exercised a saving on first cost will be made by adopting only a few beds, but experience points rather in favor of a number of small beds. It will be understood that the amount of filtering material will be the same for a given sewage flow and that the number of beds represent so many divisions of the material and consequently a greater number of fillings of the filter during a certain fixed period.

The size of the coarse and fine beds on works already constructed and in operation appear to be nearly the same, so that so far as dimensions are concerned they may be a duplicate of the fine beds

I had, at our works in Hamilton, a small experimental filter constructed in rather a novel way. It was made of tongued and grooved lumber, braced with iron rods, about thirty feet long and twelve feet wide, divided into two nearly equal compartments. The raw sewage entered at the bottom of the first compartment whence it ascended to the top, filling the compartment —it was then conveyed and distributed by perforated troughs over the surface of the second compartment. The material of the last compartment was two feet below that of the first so that there was a distance of two feet through which the sewage dripped in a fine spray. This was allowed to run for three months without being touched and the effluent was clear and of very good quality.

The first compartment was filled, first, with old broken pieces of sewer pipe, about a foot; then there came slag from the Smelting Works, about two feet, and lastly coarse coke. The next compartment was composed of fine coke, one foot, then one foot of fine coal then one foot of coke, and at the bottom a layer of very coarse gravel. The rate of filteration was about 600,000 gallons per acre. I believe the two feet drip of the sewage in fine spray had a very beneficial effect.

This filter was run for a month during the winter, and the sewage in the first compartment did not freeze, but icicles formed where the sewage dripped through the perforated holes in the wooden distributing boards, so that I had to discontinue the operations.

It is believed that when the sewage enters the filter at the bottom it is acted upon by anaerobic bacteria similar to those which liquefy the sewage in a septic tank, but the effluent is certainly not in such a putrefactive state as that from the septic tank, which latter is most offensive. The effluent from a septic tank must, of course, be passed through a filter to complete its purification. Thus the roughing filter and the septic tank are each used as a means of breaking up or liquefying the organic matter in suspension in the sewage, and preparing it for application for the fine or aerobic filter, which would soon become clogged if the raw sewage were put on it without its having been acted upon in the septic tank or rough filter; moreover it is in a condition favorable for the action of the nitrifying bacteria contained in the fine bed. The rate of filteration in some works has been greater than that already stated, but it is not well to tax the beds to their utmost capacity. Before the sewage is conducted to the filter beds it should be passed through a detritus chamber and screen, where paper, rags and other large substances will be arrested. The pipe or conduit leading the sewage from the detritus chamber to the filter beds should enter the chamber a foot or so below the surface of the water in the chamber so that the grease will collect above the sewage passing to the beds. The grease can then be skimmed off. If the separate system is in use, no provision need be made for storm water. If the combined system of sewerage exists, then provision should be made for at least the first part of a storm. No injury, however, is done to the beds by allowing the storm water to pass through.

If time permitted I could have said a great deal more on this important subject, but I trust I have said enough to interest many of those present, and to direct their attention to a method of sewage purification which appears to me destined to become one of the most satisfactory and popular methods yet devised for the purification of sewage.

DISCUSSION.

Mr. Van Buskirk—I have just read a paper by Mr. Barrow on an experimental bacterial filter plant that he has erected. He does not give us the degree or anything like that, but he states that so far as he has gone with his small filter he has got a very good result. The filters are constructed on what is known as the English system of bacterial filters.

The President—Mr. Barrow makes this statement in his paper: "Thus the rough filter and the septic tank are each used as a means of breaking up or liquefying the organic matter in the sewage, and preparing it for application in the fine filter, which would soon become clogged if the raw sewage was put on without its having been acted upon in the septic tank or in the rough filter."

About a month ago at a very cold time when the thermometer was below zero for several days, in company with a number of other members of the Canadian Society of Civil Engineers I visited the sewage filter beds at Brigden, Mass. This is one of the most perfect sewage disposal plants in America, and operating under conditions similar to those that we have in Ontario, the western part of Ontario at least. In Brigden the sewage is received into a tank that will hold sewage for at least a day. It is dumped out to filter beds in a gravelly location where the soil is gravel. First, the surface soil and the subsoil has been removed down to the gravel and sand. They have twenty-three beds of an acre each, and they pump out the sewage direct from the tank to these beds. They have found that this tank acts to a certain extent as a septic tank, although it was built before that principle was recognized. We walked all over the beds. They are perfectly clean; all that is required is to rake them in the summer time, I think, once a month or something like that. Of course, they have a large area and a comparatively small amount of sewage. The city has 40,000 inhabitants, but the amount of sewage is only 600,000 gallons. They have a good water supply, and nine-tenths of their service is metre, so that the quantity of water used per head is only thirty gallons per day, and the amount of sewage, as they have the separate system is comparatively small, being 600,000 gallons per day, as I have said before. And there they get perfect results, as shown by the chemist that they have employed in the little laboratory on the farm, who is making continuous experiments. The drains are down about eight feet below the surface, and the sewage is filtered through these eight feet of gravel, which ranges from about the size of a pea down to very fine sand.

The City Engineer told us that he might put in a septic tank as a kind of experiment to obviate the necessity of raking their beds as often as they do now. Labor there is very expensive, and if they can do that they will save a lot of money. But their system is perfect. The matter is colorless and odorless, and upon opening some bottles of it that had been there for twenty-seven hours there was not the slightest odor coming from the bottle.

Mr. E. S. Gibson—What about the atmosphere?

The President—There is no apparent odor except right where the sewage was coming out. The sewage being warm, and it being a very cold day, there was a litle vapor arising, and that had a smell. This is not for rubbish; this is for ordinary house sewage. They have very little other than house sewage. I am told it makes all the difference in the world whether the sewage is house sewage, or whether it is contaminated by manufacturing waste.

Dr. Bryce—The principles underlying the septic tank system are known to us all. I presume most of us are surprised that we know so much about it. All of us know perfectly well that if we put half a foot or eight inches of manure on the garden in the springtime there is not any manure to be found after two or three months. Possibly it has not occurred to us why this is so. Now, it is exactly the process that goes on there which underlies the whole question of the disposal of sewage by what we call bacteriolysis. If any of you will go over to the laboratory where Dr. Mackenzie works you will at once see the reason for it. You take any solution—it does not matter whether it is beef broth, sugar or gelatine, and you add a few bacteria to it; and some of them will grow freely on the surface of the solution, and some will not grow on the surface. They will grow in the centre of that gelatine; and day by day they will cause it when solid to gradually liquefy. It is a curious phenomenon, but any of you will understand it in a moment. Just to illustrate: Suppose that certain bacteria will live and multiply, taking their oxygen from the substance they live in, while others, living on the surface of the gelatine, take their oxygen readily from the air. It is now thirty years since Pasteur found it out. He found out that if he wanted to grow the yeast plant in beer work he must let any amount of oxygen be present to assist in the work. If you want to grow alcohol, or the germs which change the sugar into alcohol, keep the room saturated with carbonic acid and limit the oxygen. The germs will then do the work by taking the oxygen from the sugar and changing the sugar into alcohol and carbonic acid; in other words, much oxygen, little alcohol; less oxygen, more alcohol.

Now, in what we call the septic tank the sewage goes in and gets away from light and air and all forms of aerobic bacteria and anaerobic bacteria are carried in with the sewage from the sewer. Both of them are at work, some of them utilizing the free oxygen. The principle has been carried out in some sewage plants in the province. With carbonic acid and little oxygen present the anaerobes grow, decomposing the sewage and utilizing its oxygen and making carbonic acid on the one hand, while the hydrogen goes over and makes ammonia and sulphate of ammonia. You have got all your gases, ammonia, carbonic acid and sulphides formed.

Now, here is what is the basis of our modern septic system as the result of experiment. Mr. Scott Moncrieff seven years ago constructed in his private residence a little filter of this sort. He simply had a tank and deposited his sewage in it. The plan of this tank is published in the Report of the Provincial Board of Health for 1898. He carried the fluid sewage from the septic tank over on to a series of coke filters about the size of a pea, arranged one over the other, and tried to see what the result was, and found that in twenty minutes sewage loaded with ammonia falling on the first filter had become changed to a nitrate by the time it went through the sixth filter. It appeared that different bacteria did different work in the several filters, there being always free oxygen present. If any of you remember your old chemistry, you have your NH3. You can replace the hydrogen by HO, which is the molecule for it, and that gives you nitrous oxide gas. You can, if you like, replace two other atoms by one of oxygen; and thus if you go to the end of the oxidation you have got nitric acid. Your ammonia has been changed in these filters inside of half an hour from ammonia as it came from the septic tank to food for plants as nitrates. Down in the bottom you only have to have present lime or potash in order to give your nitre, or nitrate of potash or ammonium chloride so much, nitrous oxide so much, thus using up almost the total amount of ammonia. The nitrogen present has thus been all converted, and such is the process that goes on in what we call our sand filter or our nitrification filter on the larger scale, or the coke filter. Dr. Louis Woodhead found that in the first tank of the number of microbes in any given centimetre of sewage about three-fifths were anaerobes, the balance being aerobes, which break up the sewage in presence of free air.

The whole question, then, is a biological one of keeping out of your sewage such substances as the creosalt of gas liquors and such as come from tanneries, which may contain a certain amount of arsenic, such as might possibly do injury by their presence in preventing nitrification going on.

The whole problem has brought us back right to where we started, namely, the processes which go on in Nature's laboratory, which we are only trying to imitate, and, if possible, assist and make more useful.

Mr. Van Buskirk—From some remarks I heard yesterday and to-day I think perhaps it would be as well for us to consider where we are. A young man read a paper yesterday on the subject of the "Country Surveyor," and pictured him as an authority on all scientific matters. Then, again, to-day I notice some objections to some papers which are not of a surveying character. In order that we may grow old and grey-headed it seems to me that we must keep up with the procession; we must know all about what is going on around us in a scientific way; and it would be very surprising, no doubt, to know that many of the farmers around us know a great deal more about such questions as Dr. Bryce has been discussing than nine out of ten of the surveyors and engineers ; and I think we cannot do better than study such questions as a society. If we do not, the Society in a very short time will have its headquarters somewhere around Hudson's Bay and not in Toronto. We have got to keep up with the procession; consequently I am very much pleased to see papers of the character that Mr. Barrow has presented to the Association. I go in for this myself, but I have always read up engineering subjects. I read a paper on the same subject, and I made some experiments which I stated in that paper were bound to come before the public in a very short time as the best method of sewage disposal. Well, they have come forward, and Mr. Barrow is now writing a paper on it. The Society as a whole is not writing on it as shown by these proceedings, but none of us can afford to get behind in the race for money. We must know as much if not more than the people around us on scientific subjects in order to grow old and grey haired and be carried to the grave by the greater part of the township.

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BLAZED TREES.

By JOHN DAVIS.

Alton.

Life has been referred to under a variety of terms. It is spoken of in Holy Writ as a "fight." Longfellow speaks of the "Bivouac of Life," Shakespeare speaks of it as "a play," and Addison in his "Vision of Mirza" calls it "a dream." Surely, then, as a surveyor I may be pardoned if I refer to it as a "line" over which I have been taking a backward look. Extending, as this "line" does, over a period of twenty-five years, many portions of it are indistinct, and are barely discernible over the long stretches across which it has been drawn, extending, as it does, from the barren lands of Newfoundland to the fertile plains of the great Canadian North-west.

But although it may in places be indistinct, here and there bright spots appear, which shine out sharply and distinctly. They are the blazed trees I am going to call your attention to, by means of which memory is able to trace it through the tangled forest, over the fragrant meadow and by the shady stream. They represent little incidents and episodes—trivial in themselves, perhaps—yet serving to brighten the pathway and refresh the memory of him who attempts to retrace this line to-day. The incidents they represent are varied in character. There are the grave as well as the gay. Some are tinged with sadness, while others abound in gladness. Some are on the flinty face of the spreading beech, others are on the soft cheek of the sighing pine; but all join in telling their sweet story of a past gone forever. I cannot tell you of all those blazed trees. I can only refer to a few that stand out a little more prominently than the rest, and by whose sides the line passed in very close proximity. The first I must speak of is my connection with the kindly old gentleman, the late Charles J. Wheelock, of Orangeville, with whom it was my privilege to serve my apprenticeship. Divested of the halo which time has since thrown around him, I can still see him as one of the most gifted men with whom it has been my lot to be associated. He was truly the youngest old man I ever saw, and had a fund of wit and humor that seemed inexhaustible. He had a great love for his chosen profession, and a keen appreciation of all that was good and true in his surroundings. He was an ardent lover of nature, and admired her in whatever mood she presented herself. To know him intimately was a liberal education in itself. He was quick to appreciate a joke, and was a perfect storehouse of humorous anecdotes. Sitting in the Wellington Hotel in Guelph with him on one occasion he was accosted by a brother surveyor, the late F. J. Chadwick, who said to him, "Say, Wheelock! Are you a Freemason?" "No," said he; "I charge for my work." Whether he was facing winter's coldest blasts or sweltering under the hottest summer sun he invariably wore a high silk hat, and it was often the cause of much inconvenience to him, especially when pushing his way through thick swamps. In a farmhouse on one occasion he placed it on the floor beside his chair, where it was subsequently utilized as a seat by one of the children. He presented a most ludicrous appearance with it on his head in its damaged condition for several days thereafter till he got home. It looked for all the world like the bellows of an old concertina, and was the means of almost sending several people into convulsions with laughter.

Said he to me as I sat by his bedside only a day or so before his decease, when he was so exhausted as to be scarcely able to speak, "I'm on my last legs, John. Well, I'm not exactly on them either." And then after a brief pause said he, "I'm like Mrs. Partington. I'll soon scuffle off this mortal soil." He was a poet of no mean order, and had he chosen to allow the productions of his pen to be published, would have made his mark in that direction. The following incident will show what he could do along that line on the briefest possible notice. We had just finished a preliminary survey of the Arthur Junction Railway. Our office work had been performed in a room also occupied by a sewing machine agent. As I packed up my effects preparatory to leaving for home I came across an old pair of boots that had become unfit for further service. These I decided to leave in the office, and, placing them side by side on top of a sewing machine, I wrote a few verses, giving vent to my feelings at thus parting with my old friends, and pinned the scrap of paper on which they were written on the leg of one of the boots. I have forgotten the verses. I recollect, however, that they were execrable specimens, and exactly such as I might be expected to produce. Shortly afterwards Mr. Wheelock came in and read my effusion; then sitting down, facing the boots, he wrote the following lines, and attached the manuscript to the other boot, where I found it some weeks afterward on revisiting the office:

"A BOOTLESS TASK."

"Alack aday! Och, philaleu!
My heart is tinged with sorrow's hue;
To see you stand like empty kegs
"As stiff as pork," your feet and legs
So full of wrinkles, seams, and dints,
That one would think you had the splints.
Dear old *cow hides*—Adieu! *a due!*
My two poor *calves* are missing you;
How oft have you in former days
Upheld my feet in slippery ways,
And did my every step control
Staunch guardians of my wandering *sole!*
In rugged paths you led me through,
And helped my *understanding*, too.
I grieve to see you torn and tattered,
Begrimed with muck, and mud bespattered;
But for your use in by-gone time
Your name shall shine in jingling rhyme;
On Phœbus wings your fame shall ride
To old Parnassus' mountain side,
The muses shall with you condole,
And "lay sweet unction to your *sole*"
May set up one in state to look at,
And of the other make a bucket
To dip in pure Castilian springs,
Where oft they lave their joyous wings,
Or guild you with Pierian dye,
And make you shine like Juno's eye;
Give you a niche among the stars
With Venus or with shining Mars,
And by their fiat treat creation
To one more brilliant constellation;
Perhaps two "Fish" with glittering fins,
Perhaps—another pair of "*Twins*,"
Whilst all the spheres around our earth
Shall hold rejoicings at their birth,
Producing ample proof, indeed,
Of strength in old Dame Nature's seed
To give a pair of stellar dears
To gladden the celestial spheres,
And shed for us a *boot*-eous light
When all our lamps are out at night,
Perchance the astronomic clan
May see two "Bootes" instead of one,
Or, haply, some of them may bore us

With having found another "Taurus,"
The legs would make right lusty horns;
The head, the part that pinched my corns;
The tail—I own I cannot place it
So let imagination trace it;
But whether "Fish," "Boot's, "Bull" or "Twins,"
"It matters not a row of pins"
They'll dub you a bright constellation,
And sound your fame throughout the nation
With caustic wranglings and disputes,
Won't that be honor for my boots?

AN ARTHUR TOWNSHIP BLAZED TREE.

The next blazed tree refers to an incident that occurred in the Township of Arthur. I was standing on a fence holding a picket on the line which passed between a farmer's house and barn, when a very red-faced old man came to the back door and shouted, "What are you doing there?" His tone was so exasperating that to tease him, I replied that we were running a railway line. At this I heard his wife cry out, "Hunt them, Peter!" No more was said at the time, and I passed on with my picket. Seven years after while practising in Guelph I received a telegram asking me to come to Arthur Township and run a line for one Peter Campbell. I was met at Arthur village on my arrival there by a young man, who drove me out to the farm, and as we passed up a long lane towards a small log-house it suddenly occurred to me that this looked wonderfully like the place where the old couple had accosted me on the occasion referred to. "I wonder if those two old people are alive yet," said I to myself. On reaching the house, however, all doubts were speedily set at rest, so far as the old man was concerned at least, for there he stood at the gate; and not looking a day older either. He showed me in; and thankful was I that he showed no signs of recognition. But I felt far from safe though, for I had the old lady to deal with still. The house was one of a class common to the newer settlements, and with which nearly every surveyor is familiar. There was one large room, with two small bedrooms adjoining, separated from it by a board partition extending across the house. Entering the large room by the front door, I took a seat close beside it and awaited developments. In a few minutes in came the old lady, and took a seat directly opposite me. We chatted about the weather, the crops and other topics, but all the while she kept her eye on me in a manner that I thought boded trouble for me in the near future. I was resolved to say nothing about the affair of seven years before unless she knew me to be the guilty party. I fancy I can see her yet as she sat there before me, her broad face wreathed in a smile that seemed to plainly say, "I know you, my lad." At last she blandly enquired if I had ever been in those parts before. I knew I was done for then, for there was a twinkle in her eye that unmistakably meant mischief. Having regard to the answer I had so pertly given them on the occasion of the first interview, I think she fully expected me to come out with a flat denial. I tried an equivocal answer, however, and replied that perhaps I had been there before; that a person knocking round the country as I had been for so many years might possibly have been there before. Looking me square in the eye, she said, "Were you not out here on our fence some years ago with a flag-pole?" and pointing with her thumb over her shoulder towards the back door. I could keep a straight face no longer, and made a clean breast of the whole affair, complimenting her on her wonderful memory for faces in thus being able to recognize a complete stranger after such a lapse of time. We had a good laugh over it. Good souls! they have both passed over the river since then. Our hearts go out to them in grateful sympathy. They belong to a class rapidly passing away. They went forth into the wilderness "with tears," "sowing precious seed," whilst we who survive them are reaping the fruits of their toil and "bringing in our sheaves with rejoicing."

A ROCKY MOUNTAIN BLAZED TREE.

Shortly after locating in the City of Guelph, twenty-one years ago, I received a telegram which read as follows "meet me tomorrow to do survey at the Rocky Mountain." The last two words were so suggestive of the famous backbone of the North American Continent that I was a little staggered at first, but my neighbor, an insurance agent with a better knowledge of the surrounding country than mine informed me that it was situated a few miles north of the village of Fergus on the Owen Sound road. I was duly on hand next day, and was met by an old gentleman who owned the property I was to make a survey of. On it stood a small log building which in bygone days had been a hotel—The Rocky Mountain Hotel by name. I finished the survey that evening and had to wait till next morning for the arrival of the stage to convey me to Fergus. The old gentleman and I secured lodgings for the night at this old hotel and the evening was agreeably spent in listening to the tales he told me of the glories of the good old days when whiskey was cheap and flowed freely. He told me of the long strings of loaded teams that came down from the far north and whose drivers made things "hum" round the Rocky Mountain, on their return trips. He heaved many a sigh over the glories of those days that preceded the railway which had knocked the life out of scores of such hotels and left them sitting disconsolate by the roadsides. The hour for retiring having arrived I found that there was but one spare bed in the house and we were to occupy it. I went upstairs first and crawled in near the wall and was soon joined by the old man. He told me that one of his lungs had disappeared entirely and that the other was in a very bad condition. He had a dreadful cough, which increased in intensity after he had been in bed a short time. The cough in itself was very annoying to both of us, but there was something else that annoyed me still more. Every time he coughed he spat out into the inky darkness of the room with a vigor that surprised me considering his solitary lung. This had not gone on long till I began wondering where the several articles of my wearing apparel were located. I ran over in my mind where each had been placed, and concluded that all were out of range except my socks, which had been left on the floor. After this I spent a most anxious time. If I heard the spit strike the floor I concluded he had missed the mark, but when it fell as softly and noiselessly as the gentle snowflake on the bosom of the frozen earth, I knew he had made a bullseye. Thus passed a never to be forgotten night and if it has had no other effect it has had this, that to this day I cannot leave my socks on the floor when I retire, even if I am the sole occupant of the room. I have thus learned to treat them with a degree of respect to which they were utter strangers in my younger days.

A ROCKSIDE BLAZED TREE.

I was once engaged in running some farm lines near the small village of Rockside, in the Township of Caledon. An important stake could not be found, but I heard of an old settler of whom it was said that he could tell where it had stood. On driving to his place I found that he was assisting a neighbor, in whose barn a threshing machine was at work. Thither in turn I repaired, and enquired of the boss of the threshing machine gang where I could find him. He told me that he was in the rear of the barn working at straw, and that if I followed him he would point him out to me. I struck into the barn after him through a perfect mist of black dust. As I threaded my way through the thick atmosphere laden with the perfume of mint and other aromatic weeds, past the busy machine, and listened to its sullen roar, my mind went swiftly back to my boyhood days on the farm, and the sport we used to have when threshing days came round, and how at the close of the day we did ample justice to the apple and pumpkin pies and other good things that the farmers' wives so well know how to prepare. My reverie, however, was but of short duration, for my guide was hustling on ahead, and I had to keep him in sight. He passed round to the rear of the machine, and crossed over to the other side under the revolving wooden slats that were passing downward from the strawstack, after having duly deposited their load of straw at the top. I thought he made more of a detour than was absolutely necessary, and concluded to cut across a little nearer to the machine, over a pile of chaff that was slowly accumulating. Little did I think of the pitfalls that lay in my path. Ducking my head and shrugging my shoulders to keep out the dust and chaff blown out by the machine, I made a dash for the other side, when suddenly the floor of the barn seemed to give way beneath my feet, and I was engaged in a desperate struggle to keep from passing through to regions unknown. I had walked squarely into a large opening in the barn floor, used for letting the chaff pass through to the basement below. Had I simply allowed myself to pass through to the cellar at first I would have fared better, for the height could not have been more than ten or twelve feet, but in the confusion of the moment I fancied I might have to drop thirty or forty feet, and decided to hang on and struggle out if I could. On finding myself sinking I involuntarily threw out my arms to grasp something, but the yielding pile of chaff that surrounded me afforded but a poor hold, and I had gone through so far that my head was lower than the summit of the pile; and to make matters worse my hat had gone through, and the machine was mercilessly sifting chaff on my bare head and down my neck. Mouth, eyes and ears were full of it. After an interval of struggling that seemed an eternity, and a horrible feeling of suffocation that filled me with gloom and black despair, I at last succeeded in getting up on the barn floor. How I ever did it I cannot tell to this day. On reaching the floor, the first sight that met my bewildered gaze was that of my guide,, who, utterly unable to stand, had sat down on the barn floor to laugh. He had laughed till the operation was actually painful. Rising, and still holding his sides, he came forward and tried to apologize for not having informed me of the presence of the hole, but a fit of laughter again supervening, he had to leave me and have it out. I then went round the barn to look up my hat in the basement below, and there lying on his back in the chaff was another individual, indulging in more than moderate merriment, who had been an eye-witness of my frantic struggles from below. I learned afterwards that at the supper table the wildest of hilarity prevailed as these fellows graphically described what they had been eye-witnesses of.

I desire in closing to express the regret I feel that through neglect on the part of the older members of our profession vast stores of interesting experiences have been allowed to slip from us and fade away into the insatiable past. Our surveyors have passed to and fro in the land, doing well their work; but how little of their inner lives has been revealed to us! They have staked out their boundaries, and left their technical records in description thereof, but how little they have told us of the real lines of life that they ran, and of the "Blazed Trees" that stud the way. I would, therefore, earnestly urge every land surveyor to pause once in a while and take a backward look over the line of life that he has been running, noting well the "Blazed Trees," and making a record thereof, that may be handed down to his successors, knowing well that such records will be appreciated by them as something of paramount importance and interest.

DISCUSSION.

Mr. Niven—When I saw the paper, "Blazed Trees," on the programme I expected to hear a different paper. However, it has been very interesting and amusing. With reference to the principal character, Mr. Wheelock I may say that I met him many years ago; in fact, the first year I was a pupil with Mr. Passmore, Mr. Wheelock had not been out long from Ireland, and I remember him as a very genial kind of man; in fact, the pupils in the office were always very glad to see him. He always carried with him an immense big transit with two telescopes; and he would always say that he never felt right unless he had it on his back. I know Mr. Wheelock was in Orangeville as long ago as 1857, and he remained there until his death. I saw him four or five years ago. I remember him very well.

The President—This contribution to our Proceedings, gentlemen, I am sure, will be a very charming one to have printed in our Report. We were not aware that we had a member with such literary attainments as our friend, Mr. Davis, and I hope he will be able to turn them to good account in the future. I shall be glad to receive a motion of a vote of thanks to Mr. Davis for the paper, which is of more than ordinary interest.

Mr. Niven—I move that a vote of thanks be given to Mr. Davis for his paper. It is a little out of the general run of surveying papers, but it is very interesting all the same.

Mr. H. H. Gibson—I take great pleasure in seconding this motion. I was thinking while it was being read that it might be a continuation of my paper—it follows so much on the same lines; but he entered into somewhat different details from what I did.

Mr. Davis—I am sure I feel very thankful, gentlemen, for the flattering vote of thanks you have accorded me. The only object I had in writing this paper was to give information, and, if possible, draw out some more papers of this class. There is nothing that is so interesting to the average individual as reminiscences that are met with in practice; and who is there who has a more general round of interesting experiences than the surveyor. They meet people under all phases of existence, and they have opportunities of observing life in a variety of ways that ordinary men have not, and yet how little we hear of these experiences.

[*This Association is not responsible as a body for the opinions expressed in its Papers by Authors.*]

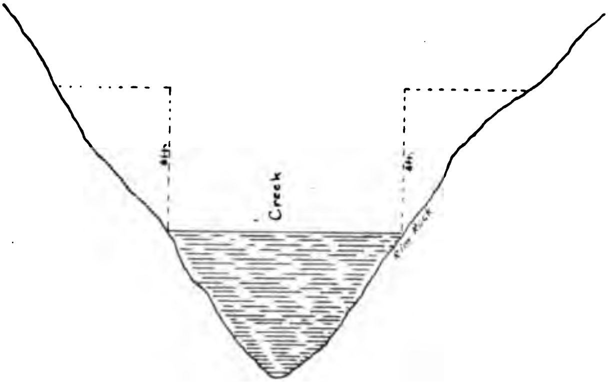
MINING REGULATIONS (YUKON).

BY T. FAWCETT.

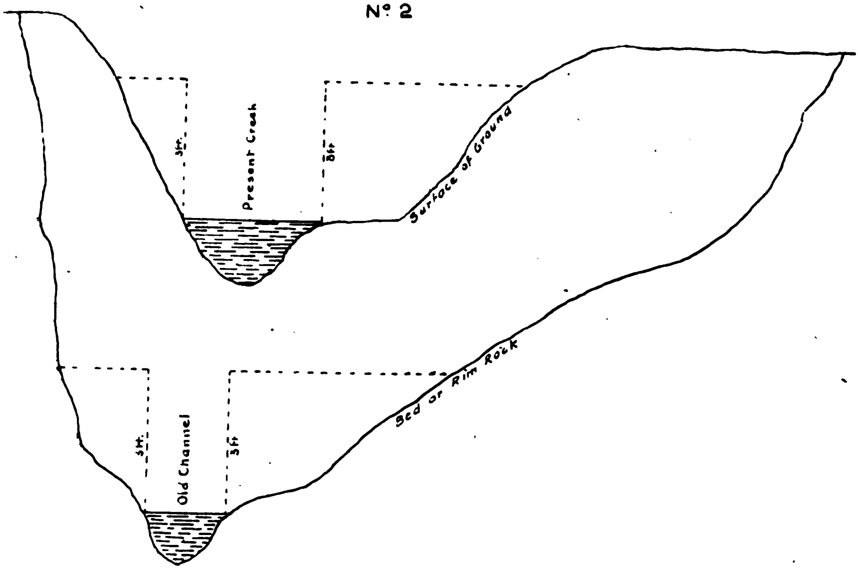
Mr. Fawcett prefaced the reading of his paper by saying that: " If this paper had been read a year and a half ago it would have been more interesting than now; but as some of the gentlemen present were there last season they will understand the points I have mentioned on the work of the surveyor.

Mr. President and Gentlemen,—In bringing this paper before you I do so with some hesitation, because it may not seem judicious to publicly point out or criticize measures and laws which have been recommended by other members of this Association, members of high standing, whose opinions are taken almost as authority, not only in many questions of law, but also in questions which are more particularly interesting to the surveyor.

It became necessary for the writer, when appointed to the office of Gold Commissioner of the Yukon territory three years ago, to make a particular study of the regulations governing placer mining in that country. The regulations which had been adopted by order-in-council to govern the disposal of mineral lands in the North-West Territories had previous to that time been amended in the direction of allowing a larger claim in the Yukon Territory than was allowable in the North-West; the other sections remained the same. In the spring of 1897 a code of laws was drawn up and adopted for the Yukon territory, which contained little more than an abridgement of those which had been in force before. It was early seen that there was difficulty ahead of the surveyor who might be called upon to survey the creek or gulch claims which at that time were defined as extending 500 feet in the general direction of the stream, and from base to base of hill. The wording seems simple enough, and in some places there is no difficulty in coming to an agreement, as to where the base of the hill would be, but in other cases it is not so simple; perhaps no two of us would agree on the


4ft.
Creek
4ft.
Rim Rock

No. 2


3ft.
Present Creek
3ft
Surface of Ground
3ft.
Old Channel
3ft
Bed or Rim Rock

783050 A

same point. The rise in places was so gradual that it would require a level to show that there was a rise, and in others there might be a flat, miles in extent. Under these regulations claims might extend to an indefinite distance at right angles to the general direction of the stream if no hill came in the way to limit them. In the regulations which were authorized by Parliament in January, 1898, this defect was remedied by limiting the claims to 1,000 feet from the centre of the stream where the distance to the base of the hill exceeded 1,000 feet. There had been some five thousand claims registered under the other regulations before this change became the law. In returning to this "base of hill" question, Dominion Land Surveyor Ogilvie, when surveying claims on Bonanza and Eldorado creeks in the winter of 1897 recognized the fact that there was something more required before a surveyor could put down his stakes and say, "Here is the boundary between the creek and hill claims." He set out stakes at right angles to his traverse line, but he did not pretend to place them so as to limit the width of the claims. This was evidenced by the fact that the stakes were often a considerable distance up the hill sides, and were only set for alignment across the valley. At the time I arrived in Dawson in the spring of 1897, there were a good many cases of dispute where men were locating claims on the hill sides, and trespassing on what the owners of creek claims adjoining, thought was their ground. It was a daily event to be waited upon by a deputation or by single miners seeking injunctions to stop others from prospecting on ground which they claimed. Mr. Ogilvie, who had discussed this question with some of the British Columbia miners, arrived at the conclusion that a certain rise of the bed rock should form the boundary, and announced his intention of recommending a change in the mining regulations, substituting this provision instead of the clause, "from base to base of hill." I foresaw trouble ahead if this change should be adopted, and immediately wrote to the Department, expressing my objections to the change, and recommending instead that the claims be made a definite size—square would probably be the best; and let the boundaries be governed by the stakes at the corners. Any one familiar with conditions in that country would tell you that if this had been done a fortune would have been saved to many a man, who has been ruined through litigation. In the regulations, which were adopted by order-in-council, January 18, 1898, Section 10 reads as follows:

"A creek or gulch claim shall be 250 feet long, measured in the general direction of the creek or gulch. The boundaries of the claim which run in the general direction of the creek or gulch shall be lines along bed or rim rock, three feet higher than the rim or edge of the creek, or the lowest general level of the gulch within the claim, so drawn or marked as to be at every point three feet above the rim or edge of the creek, or the lowest general level of the gulch, opposite to it at right angles to the general direction of the claim for its length, but such boundaries shall not in any case exceed 1,000 feet on each side of the centre of the stream or gulch. (See Diagram No. 1.)

On turning to that diagram we find the rim rock coming out at the edge of the water, while the surface of the ground is not shown at all. There are cases where an outcrop of rock is found at the creek as shown in the diagram, but in nine cases out of ten the rock is anywhere from fifteen to two hundred feet beneath the surface of the ground, and many feet beneath the present creek channel, and a true cross section would appear as shown in diagram No. 2. Taking the wording of the definition and Diagram No. 1 together, it is shown to be ambiguous. When the writer received notice of this change in the mining regulations, and not wishing to act altogether on his own ideas as to the meaning of the term, "rim of the creek," he called on Col. Bowie an eminent authority on placer mining, at that time a resident of Dawson, and submitted the problem to him. Col. Bowie's definition of, "The rim of the creek," was the boundary of the creek channel, either above or beneath the surface of the earth, where the bed or rim rock had been broken or worn away." A similar explanation was given by Mr. Alfred Tregidgo, another mining engineer, to whom I submitted the same problem. These definitions coincided with my own ideas as to the intention of the clause as shown by the diagram. I, therefore, accepted that as the true meaning, and instructed the mining inspectors and all other inquirers accordingly; and that became the accepted interpretation until the fall of 1898, when, upon Commissioner Ogilvie's arrival at Dawson, he informed us that this was not the meaning of the Act; that the boundary intended was where a horizontal plane produced from the creek would intersect the bed rock three feet higher than the rim of the present creek channel. The boundary, which would be determined according to the two definitions, is illustrated in my Fig. 2.

One objection I raised to the first definition was that three feet of a rise was not sufficient to make allowance for ordinary undulations and natural irregularities of the bed rock, as these vary on the bed rock about the same as the surface of the ground. It was my explaining this to Commissioner Ogilvie which brought to his attention this ambiguity in that portion of the mining regulations, and he proposed having the defect remedied by having the diagrams changed so as to show the horizontal plane extended from points three feet above the edge of the present channel of the creek.

If this provision for overcoming the difficulty were applicable there would still be the undetermined problem, viz., the finding of the exact rim or edge of the creek. The edge of the water is seldom, if ever, at the same exact altitude for two days in succession. The limit of vegetation differs at every point along the creek, and is not the same on both sides of the creek. The surface through which the stream has cut its channel is undulating, so that the "rim of the creek" under the latter definition is quite as indefinite a term as the "base of the hill," as it appeared in the section which this clause was intended to amend. In conversation with miners, who spoke of the rising of bed rock as the true base of the hill, I found that they did not generally understand that the bed rock must rise to a point above the present channel of the creek, but that it must rise to a plane higher than the bed rock underneath the flat. Had the law allowed say seven feet or sufficient to overcome the natural undulations of an elevation above the rocky rim of the creek, there would have been little objection on the part of the miner. There still remains the indeterminate nature of the problem, viz., the impossibility of any engineer, however well qualified he may be, determining the elevation of the bed rock from the surface of the ground, when bed rock is anywhere from fifteen feet to two hundred feet beneath the surface of the ground, and of marking the boundary on the surface.

While in the Yukon territory I recommended some amendments to be substituted for these unworkable clauses, to overcome as far as possible the mischief worked by them, but my recommendations were not wanted, i.e., they were not approved by Commissioner Ogilvie, and as I did not return to the Yukon to survey the boundaries of mining claims, I left the matter for those on the ground to fight out as best they could. A prominent British capitalist who returned from Dawson without purchasing claims for parties who employed him said, that to purchase a claim was purchasing a lawsuit, and he certainly was not far astray.

Another source of litigation arose through substituting the Regulations approved by Order-in-Council on the 21st March, 1898, for those bearing date of 9th November, 1889, referred to in Section 40 of the Regulations governing placer mining. Sec. 14 of the last named read as follows: "When there are two or more applicants for any mining location, no one of whom is the original discoverer or his assignee, the Minister of the Interior, if he sees fit to dispose of the location, shall invite their competitive tender, or shall put it up for public tender or auction as he may deem expedient. To show how useful that Section might become I will refer to the conditions which prevailed in the month of September, 1898, at which time claims which had not been worked in accordance with the mining regulations, were thrown open for re-location. During that month, upwards of one thousand applications were received together with the entrance fees, and placed on file. For the majority of the claims there were several applicants, and the leases couldn't be granted until these several applicants appeared together with their witnesses before the Gold Commissioner and obtained a hearing, which sometimes extended over two or three days. Had the section which I have quoted, from the former regulations been still in force, how quickly and easily all these cases could have been adjusted. The applicants offering the largest amount would have got the claim, while the other applicants would have had their money returned to them, and could have gone and sought a claim elsewhere. Up to last fall those cases had not all been disposed of, but to prevent trouble in that direction in future, the regulations were so amended that now all unrepresented claims revert to the crown and are not now available for settlement as mineral lands. In the case of fractions, the revoked section would have been most useful. All fractions, since the summer of 1898, have been held as alternate claims for the crown.

It would be in the interest of both the miner and the crown, that some provision be made for disposing of these fractions with as little delay as possible, after it had been ascertained that they have a real existence. I may here state that in the early history of the camps, many certificates were granted for fractional claims, which after the measurement of the original claims, were found to have no real existence. Those who had been granted certificates either made a mistaken affidavit through their inability to measure accurately, or purposely perjured themselves for the purpose of obtaining a certificate to sell, and cheat some-one out of their money. In granting certificates for these fractional claims we usually required not only the affidavit of the applicant himself, but also of the man who assisted the applicant to measure the claim. These certificates, supposed to represent claims, were many of them sold, and some of them for large amounts, and in some cases the purchasers found they had been swindled. Early in the spring of 1898, I refused to grant any more certificates for fractions unless the application was accompanied by a surveyor's certificate, and a sketch showing the measurements of the claim, and I recommended at the same time that fractions be held for the crown, that a double benefit might result therefrom.

First—Purchasers would be protected against purchasing fractional claims which might be found to be non-existent. Second—The fractions which did exist, if sold, would pay the cost of the survey, which in that country would otherwise demand a large appropriation—the expense being at least three times as great as it would be to survey and lay out claims on vacant ground, owing to the length of time which would necessarily be consumed in searching for original stakes, taking evidence, examining records, etc. The additional cost of surveying claims already recorded, in many cases, overlapping each other and irregular in shape, is the problem which the surveyor has to face. I will here note my reasons for urging that provision should be made for the early disposal of fractional claims. In many places where fractions are found the original claims of which they formed a part are being worked as well as the claims adjoining them, and as operations are carried on far beneath the surface of the ground, it is the easiest thing imaginable for those fractions to be undermined, in fact it would be a matter for surprise if they were not worked out by adjoining claimants. As to question of value, the fractions would be worth more to owners of adjoining claims than to any one else, because when working out the claim, the fraction could be worked out without the extra cost of opening up the ground, together with the expense for dams, sluice boxes, transport, etc., all of which would be unnecessary if the fraction were worked out in conjunction with one of the adjoining claims. As the creek claims between Upper and Lower Discovery on Dominion Creek are being worked this winter extensively, and a list of the fractional claims had been made out and advertised for sale by the Department—I am sure the purchasers of these fractions will be somewhat interested in this part of my paper—of those fractions particularly which have not been acquired by the owners of adjoining claims.

When the regulation reserving alternate blocks of ten claims to the crown reached Dawson, I saw the necessity of adopting a rule for the guidance of those seeking claims, that they might know where to stake. The instructions given to prospectors, miners, mining recorders and others were, that the discovery claim whether a single or double claim should count as one and be numbered (0). That this claim and nine claims above discovery would be open for staking by the people, while the first block of ten claims below would be reserved for the crown. This gave uniformity in numbering, the same numbers belonging to government blocks, whether they begin at the mouth of a stream or some distance up, while measuring up stream. These instructions were made public through posting up notices, and publishing in the local papers, also in a small directory published as a private enterprise, which contained also, all the local rulings regarding representation and other matters pertaining to mining. There was a great deal to be said in reference to the law as it applied to the representation of claims, but as that part has been changed entirely, and provision made whereby a man may pay a sum of money at the recorder's office in lieu of representation, and the claims not being open for re-location by the public, I need not say any more on this subject except that if the amendment had been made a year and a half earlier, that feeling of distrust in reference to title which has hindered investment of capital to a considerable extent, would have been prevented. Where the land will never be valuable for anything except the mineral which it contains, and will be valueless and deserted as soon as the metal has been extracted, it would, I think, be for the benefit of the country, and aid in its development, if the same sort of title could be granted to placer ground as that granted for mineral lands containing rock in places. Such a title for valuable property would command a good figure. The limitation contained in Section 22, which reads: "A claim shall be recorded with the mining recorder in whose district it is situated within ten days after the location thereof, if it is located within ten miles of the mining recorder's office," is not an improvement on the former Regulations, which allowed sixty days after staking for the purpose of prospecting a claim to ascertain if it would be worth recording. If the word "pre-empted" were substituted for the word "recorded" in the first line of the section, it would give general satisfaction. I am not acquainted with any creek in the vicinity of Dawson where two men could sink a shaft to bed rock in ten days. The average length of time for sinking a shaft to bed rock would be a month, and it often becomes necessary to sink three or four shafts before it can be ascertained whether the claim will be worth recording. Any man who values his rights and intends to mine, don't want to throw it away on a valueless piece of ground, and it is scarcely treating him with ordinary fairness to compel him to do so. The man who simply locates a claim, and procures a certificate for the purpose of selling, does not care to prospect, he merely sells for as high a figure as he can get. If a man were required to have his claim noted at the office for preemption for the purpose of protecting his right until he could do the necessary prospecting, he would not be required to sacrifice his right without knowing whether his claim contained mineral or was worthless. The entrance fee might be collected when the application for pre-emption was made, or otherwise, a regular fee for recording pre-emptions might be charged, as well as a fee for recording abandonment of these if the claim was not deemed worth holding. Miners with whom I discoursed on the above subject have said, they would much rather pay the fifteen dollars' fee, for the privilege of prospecting, and lose it, than record a claim which turned out to be worthless. There are many other points in connection with the mining regulations which might be discussed with profit, but my paper is already quite lengthy enough, and I trust will have some interest for the members of this Association.

DISCUSSION.

The President—We begin to understand some of the difficulties of the officials in that distant country after listening to this paper. It will be a valuable contribution to our annual report. No doubt many of you will remember that a year ago, when Mr. Ogilvie contributed a paper on the Yukon, at that time very little was known about the country, and there was very little attention paid to it. But it has been a source of great satisfaction to us to know that our Proceedings contained the first account of that wonderful land of gold.

Mr. E. Bolton—I accompanied Mr. Fawcett in the summer of 1897, and I can say that he is perfectly correct in everything he says; the conditions of the country were so different from any other place. He has put some of the facts in very good shape, and very plainly.

Mr. Sankey—In listening to the paper it occurred to me that unless one was very well versed it was rather hard to follow. In the first place, I am ignorant as to whether the claims are first to be certified by the surveyor; and I assume that this is possible from the occurrence of the fractional sections or portions. Perhaps Mr. Fawcett will be kind enough to give an explanation, that we may know not only for ourselves, but that it may also be put into the Report, for many people who read our Reports do not belong to Ontario at all.

Mr. Fawcett—The claims of that country are all staked and recorded long before any surveyor is on the ground.

Mr. Sankey—Did the fractions occur from the survey made?

Mr. Fawcett—Yes. In the first place when Mr. Ogilvie went up to survey, the people were disputing over their ground. He measured the claims, and after measuring off the claims all exceeding 500 feet was cut off, and that was a fraction. He cut off the fraction, and just allowed 500 feet.

Mr. Sankey—What happened in the case of the work being done on the fractional part?

Mr. Fawcett—That is where the people have no certainty; they have no way of knowing that their fraction has not already been worked out.

Mr. Aylesworth—I move that Mr. Fawcett's paper be received and printed in the Proceedings, and that the thanks of the Association be tendered to Mr. Fawcett.

Mr. Ross—I second that.

Mr. Bolton, Sr.—I think, as far as I am concerned, I know what difficulties there are, but I would not wish to place all the knotty questions before this Association. The only way that you can appreciate that kind of thing is to go there. I know all I want to know about that, and I do not think it would be very instructive to the members of the Association unless they had something to do in the survey of the country. In what Mr. Fawcett has said he has explained the whole matter thoroughly, and I think that any comments on my part would be useless. I am satisfied that the present mining regulations are not just exactly what they should be. I think that what Mr. Fawcett says about them is practically right. The difficulties set forth in Mr. Fawcett's paper are very striking. It is a very hard matter to say what the mining regulations of that country are. There are just as many different kinds of humanity in that country as you will find anywhere, and it is a pretty hard matter to make laws that will govern every case. During the two summers I was there I found a great many difficulties in satisfying the laws in making surveys. The laws in a good many places, so far as the creek claims are concerned, are very indefinite, and especially that one in reference to the boundary between the creek claim and the hillside claim. That is a matter that I think every surveyor in that country feels a difficulty in determining, and it is for this reason that there has been a great deal of money spent in litigation. I do not think it is necessary for me to say anything more on the subject at present unless some member would like to ask questions. Motion carried.

[This Association is not responsible as a body for the opinions expressed in its Papers by Authors.]

THE YUKON COUNTRY.

E. D. BOLTON.

On May 6, 1899, I left Toronto via the C. P. R. for the Yukon to act as assistant to Mr. Thos. Fawcett, D.L.S., gold commissioner for the district, arriving at Vancouver on the 10th day of May. The following day I took the boat to Victoria, where I found Mr. Fawcett and party busily engaged completing our outfit for the journey. On May 15th we sailed on the steamer "City of Topeka" for Juneau, arriving there on May 18th. Juneau has a population of about 2,500, and is situated on an Island at the mouth of the Lynn canal. While there we visited Douglas Island, on which is situated the Treadwell Mine, having the biggest stamp mill on the American continent, some of the ore used not running $2 to the ton. We then started up the Lynn canal on a small steamer, and reached Dyea on May 21st. Dyea is situated on the left arm of the Lynn canal, the distance from Juneau being about 100 miles. On our way to Dyea we stopped on the right arm of the canal to wait for the tide, this place being only a few miles from Dyea, where now is situated the town of Skagway, with a population of over 4.000 people. When we landed in 1897 the place was nothing but a wilderness. There was one hut, in which lived Captain Moore, a pioneer, who then laid claim to a portion of the land. After landing at Dyea on May 24th, we commenced packing our outfit, which consisted of kit-bags, provisions and surveying instruments. We tracked part of our outfit in boats and canoes five miles up the Dyea River, the remainder being taken in a waggon. From here we packed our outfit, including two canoes, to the summit of the coast range, over the Chilkoot pass, and in doing so had considerable difficulty.

There is a good sized glacier on the left of the trail, about two miles below the summit, aud while there we could see large pieces of ice breaking off of it, which sounded like thunder as they rolled down the mountain side. Once landed at the summit we procured sleighs, and sledded our outfit down the pass, a distance of about six miles, to within about two miles of Lake Linderman. Across this two miles we packed our outfit, and landed it at the head of the lake on June 7th. We then transported across the lake in boats and canoes, it being about four miles. We then packed three-quarters of a mile across the portage to the road to lake Bennet. While at Linderman Mr. Fawcett, in company with one man left for Dawson, arriving there about June 16th.

At Bennett and Linderman, and scattered along the portage between the lakes, there were about 1,000 people, building boats and getting ready to go down the river, their tents scattered all over the place. About a mile from Bennett there was a sawmill, where we procured a boat twenty-three feet long, made of three-eighth inch spruce, spruce being the only available timber there, and found up to about fourteen inches in diameter. The small price paid for the boat was $75. We then loaded our outfit in it and a Peterborough canoe, and on June 12th started for the gold fields. The trip down the river is delightful as soon as you get across the lakes and into the river. The paddling of a canoe is not so hard, as the strong current carries one right along, the current in some places being five miles an hour. We arrived at Fort Selkirk on June 22nd, and there found instructions to complete some surveys which had been commenced by Mr. William Ogilvie, D.L.S., Mr. James Gibbon, D.L.S., being in charge of the survey. We laid out at this point over 1,000 acres, including forty acres for a Government reserve. Fort Selkirk is the best situation for a town site of any place on the river, and is 180 miles above Dawson. There are a number of Indians here, and also a trading store, owned at that time by Messrs. Harper and Ladue, an Englishman, Wm. Pitt by name, being in charge, who did all the trading with the Indians. The stock-in-trade then consisted of eight sacks of flour, a few odds and ends in groceries, a few articles of dry goods, 100 fox skins, mocassins and mittens, 400 bearskins, and about 800 tanned cariboo and moose skins, the moose and cariboo being shipped to Dawson in the fall for the making of mocassins, and brought from ten to twenty dollars apiece. At Selkirk on the 1st of July I picked ripe strawberries in a hay meadow about three miles back of the fort. I almost forgot to mention that coming down the river we did not run any of the rapids with our canoe. Our big boat went safely through the Canyon and Five Fingers, and we portaged over the White Horse rapids, Canyon and White Horse being only two and a half miles apart, the water between them being very rapid and dangerous. On Monday, July 5th, we left Selkirk for Stewart River, a distance of 110 miles, arriving there the following afternoon. We travelled the distance of ten miles between White River and Stewart in fifty minutes. At Stewart River we made several surveys, including a Government reserve of forty acres. The land applied for, both at Fort Selkirk and Stewart River, was not granted to the applicants. The valley of the Yukon in the months of June and July is lined with wild flowers of various kinds; wild roses grow in abundance. The most of the flowers of that country are of a violet or purple hue. The islands in the Yukon are thickly wooded in places, the timber being chiefly of spruce, with some small white birch and poplar. While surveying at Stewart River we came across some spruce trees that would measure two feet in diameter.

The varieties of wild fruit found along the valley of the river are cranberries, strawberries, blue berries, raspberries and red and black currants. On July 17th we left Stewart River for Dawson, and canoed the distance seventy miles in ten hours, arriving there in the evening. The population of Dawson when we arrived would be about two thousand. We camped on the police reserve, and lived in tents the remainder of the summer; in the fall we moved into a snug little cabin built by our party. The Gold Commissioner's office, which was situated near the lower end of the town, seemed to be the principal place of attendance. Some mornings when we went down to the office we would find a line of men from two to six deep, reaching from the office to the bank of the river, and numbering over two hundred, eager to get in and record their claims. With regard to the first discovery of gold in the Klondyke, I may say that the gold diggings before this were situated down on the tributaries of Forty-mile River, near the boundary line, and about fifty miles below Dawson, the principal creeks being Miller and Glacier, the pay dirt running from five to ten cents to the pan. In the first months of 1896 a few miners found their way up the river to the Irvandik, where gold was found on Bonanza, Eldorado, Hunker, Gold Bottom and Last Chance Creek, although some time before this gold was discovered on Quartz Creek, a tributary of Indian River. Shortly after this the richness of these creeks was soon known, Eldorado being the richest, then Bonanza and Hunker. Some of the best claims on Eldorado selling for $100 now are worth $200,000. As soon as Mr. Fawcett arrived in 1897 he divided the country into mining divisions. Every creek or river flowing into the Yukon together with its tributaries, comprised a division, and each miner was entitled to record a claim in each division. The creek claims at this time were 500 feet in length, the discovery claim being 1,000 feet in length. The bench claims were 100 feet square, the same as in British Columbia. Up until July, 1897, there were less than half a dozen bench claims located, being on Eldorado and Bonanza Creeks. In September, 1897, bench claims took a jump, and many were located on these two creeks, and now bench and hillside claims are to be found on all the principal creeks in the district; in some places on Hunker Creek they extend back from the creek a distance of over half a mile. Some of the richest claims in the country are bench and hillsides. On French Hill, situated on the left limit of Eldorado Creek, between claims Nos. 17 and 13, is a large group of 100-foot bench claims. On May 1, 1898, I visited some of these claims, and several of them were, with one rocker, producing about $1,000 a day, the gold being coarse and in nuggets, some weighing over two ounces. In 1898, when the new regulations came into force, the size of creek claims were cut down to 200 feet in length, although a 100-foot law before this was never put into force. Every alternate ten claims are reserved for the Crown; discovery claims being 400 feet in length, and nine additional claims above this are put on record, and then the ten claims above and ten below this are reserved for the Crown. All the creeks in the county where claims have been recorded in this manner have remained unprospected and undeveloped, for the reason that the individual miner is not going to develop ground for the benefit of the Government. The size of hillside claims are in length 250 feet, up and down stream, and extending at right angles to a base line of the creek 1,000 feet. Bench claims are 250 feet square, and are mostly located back of the hillside claims.

With regard to quartz claims, I may say that they are located all over for a radius of fifty miles around Dawson, but as yet they have been found to be worthless. There are no well-defined quartz ledges in the country, and no rock of any kind found in the place. My opinion is that the country at one time has been over-run with quartz ledges, and that these through time have worn down, and the placer diggings of this region are the result of these worn-down ledges. Most of the gold nuggets found are mixed with quartz, and I have often seen in a gold pan when the dust was being cleaned up over a cupful of fine particles of quartz. Black sand is found along with the gold dust, some creeks being worse than others for it. On Dominion Creek, a tributary of Indian River, it is found in very large quantities. The principal creeks on which good pay dirt is found are the following: Eldorado, Bonanza, Hunker, Dominion, Sulphur, Gold Run and Quartz Creek.

Concerning hydraulic mining, I may say that up to the first of October last there were only about half a dozen leases granted for hydraulic mining concessions in the Yukon territory, the first being for two and a half miles of ground near the mouth of Hunker Creek; the second being for ground on the left limit of Bonanza Creek. There were, last September, in all, over fifty applications in for hydraulic mining for ground on the Yukon River, Irvandik River, Bonanza Creek, Eldorado Creek, Hunker Creek, Indian River, Dominion Creek, Quartz Creek, Stewart River and its tributaries, Forty-mile River and tributaries and others. There is plenty of good ground suitable for this method of mining that would yield from two to ten cents to the pan, but the scarcity of water prevents this ground from being worked. There are two large schemes on foot now. One is to bring water down in a flume or ditch from the head waters of the Irvandik. The other is to pump water out of the Yukon and over the divide to the head of Eldorado Creek; but I don't think either of these will be carried out, as the cost would be greater than the benefits derived therefrom. Coal is found along the Yukon in a number of places, one near Five Finger Rapids, and several below Dawson. On Cole Creek, sixty miles below Dawson, last summer the North American Trading and Transportation Company did considerable development work on their property. They shipped to Dawson over 1,000 tons, to be sold at $25 a ton. This coal seemed to be very clean, and was reported as being of good quality. The Alaska Commercial Company also have coal locations down the river, but the coal does not seem to be of uniform quality, and the vein is too thin to be worked to advantage. According to recent information, derived from Dawson through the "Toronto Globe," the Alaska Exploration Company for the past six months have been tunnelling for coal on Rock Creek, a tributary of the Irvandik River, entering from the right bank, about fifteen miles above its mouth. They have finally opened what they hope will prove a permanent seam or series of seams, they have tunnelled 800 feet, 400 feet of which are side galleries, and two of these run through coarse seams seven or eight feet thick. The men are working at a depth of 250 feet and at present there is about 1.000 tons of coal exposed to view. The coal is bituminous in character. This is the nearest coal-find in the vicinity of Dawson, and is seven miles up the creek, from its mouth. Should the mine prove permanent it is the intention of the Company to build a tramroad from the property to Dawson, which would land the product of the mine right in the town.

I will now give you a short account of the business done in Dawson, in 1897 and up until the fall of 1898, the most of the trade was done by the North American Trading and Transportation Co., and the Alaska Commercial Co. These companies steadily increased their business as the increase in the population demanded it. The Alaska Commercial Co. have now seven river boats costing at least over $400,000, also a large store and four large warehouses.

The North American Trading and Transportation Co. have about the same number of boats, but not as elaborate as those of the former company. They also have a large store and five warehouses, besides a number of very valuable mining claims. These two companies transacted business without opposition until the fall of 1898, when the Alaska Exploration Co. brought in a large stock of goods, and commenced building warehouses and stores. This company have now three large warehouses, four river boats, and the finest store in Dawson, and have in some particulars outshone the other companies: counters, shelves and store fixings all made of imported woods, and in every particular up to date. Besides these there are other smaller companies now doing business. When we arrived in Dawson in 1897 supplies of all kinds were very scarce as the up-river boats had not yet arrived from St. Michael's. The miners had plenty of money but nothing to buy except a little bad whiskey. The river boats only make two to three trips in a summer, the mouth of the river not being open until about the middle of June. It takes a boat from twenty to thirty days to make the trip of 1,700 miles from St. Michael's to Dawson, and about seven days to make the trip back again; this, of course, not counting the time spent being stranded on sand bars, as the river in some places is very bad. There is one place in the river called the Yukon Flats, about 400 miles below Dawson, where it widens out to a width of about ten miles. Here the river is very shallow, and the channel changing and shifting all the time. River men have told me that they are very seldom able to pass through this part of the river twice in the same place.

There are now about fifty river steamers plying up and down the Yukon, ranging in draught from one foot up to four and a half feet.

I will now attempt to give a short account of some prices paid for different articles in Dawson. Of course, the prices change as the stock in trade increases or diminishes. In the summer of 1897 flour sold for $8 per fifty pound sack; sugar, 50c. per pound; bacon, 50c.; fresh meat, 75c. to $1; canned meats, 50c. to $1 per can; butter, $1; candles, $5 per box of fifty; boots, $8 to $10 per pair; top shirts, $3 to $4; good suit of ready-made clothing, $50; coal oil, 50c. per gallon; dried fruit, 50 to 75c. per pound. Later in the fall and winter, as nearly everything became scarce, flour sold for $50 per sack; bacon, $1; candles, $10 to $20 a box; coal oil, $5 per gallon; butter, $3 to $5 per pound; moccasins, $10 per pair; wood, $35 a cord, and hay, $400 a ton, the hay being cut along the valley of the Stewart and Yukon and brought down the river on rafts. Horses sold from $300 to $500 apiece; ordinary lumber suitable for building from $75 to $100 per 1,000 feet, and sluice timber, where ten and twelve-inch boards are used, generally brought a higher price. Rents were very high until the summer of 1899, when a good cabin, about 14 by 16 feet, in the central part of the town, could be rented for $25 a month. Before this I have seen the same sized cabins bring $75 a month. On Main Street last summer along the river front in the business part of the town ground rent was $10 a foot per month. Sled dogs ranged from $50 to $100 a piece, although once I saw four large huskies sold for $1,000, but these very fine animals. The first fresh eggs brought into Dawson in the spring of 1898 sold for $18 per dozen. These prices will perhaps never be realized again in that country, as everything is now working down to a level, and keen competition exists in every line of business. Prices last fall were the following: Flour, $6 per sack; bacon, 25c.; ham, 35c.; canned meats, 50c.; sugar, 30c.; beans, 25c.; butter, 75c. to $1; dried fruit, 25c to 50c.; eggs, $2 per dozen.

With regard to the climatic conditions in the country, I may say that, although the winters are very cold and the summers are hot, one does not feel it as much as would be expected in that north country. There is very little wind, and the weather is steady, and not like it is in this part of the country, summer to-day, followed by winter to-morrow. The average of rain and snowfall is not nearly as much as here. The total snowfall in the winter of 1897-98 was a little over three feet, and in the winter of 1898-99 a little over two feet. The heaviest rain falls exist in the months of June and July, when the river is then at its highest, the fall after that being very light. The lowest temperature we had in the winter of 1897-98 was on the last day of November and the first day of December, when Nigretti & Zamba's minimum thermometer registered 55 degs. below zero. The lowest temperature in the winter of 1898-99, according to the same thermometer, was 47.5 degs. below zero, the former winter being more severe than the latter. The Yukon remains frozen over from six to seven months in the year, and navigation can safely be conducted from about the middle of May until the first of October. In September the river gets low, and the boats are continually coming into contact with shoals and sandbars, and navigation becomes difficult. The ice coming in from the tributaries generally runs ten days or two weeks before the river becomes entirely frozen over. The water in the Yukon in the summer is of a muddy color, but as soon as it becomes frozen over, the water becomes clear. I have seen the ice in the river attain a depth of over seven feet, and in some places, in the eddies near the shore, I have no doubt it would be ten feet.

My term of office with the Government expired on May 1, 1899, and since that time I have been in business for myself. I will now give a short account of my trip out last fall. On September 26th we left Dawson on the steamer "Victorian" with over 100 passengers on board, and anchored that night at Monte Cristo Island, twenty miles nearer home. About six miles up we passed the Government telegraph line, it then being completed to this point. On the night of September 28th we tied up at Selwyn River, and here found that the telegraph line had been completed to Dawson. This was quite an advantage, as we could at the different stations find out the whereabouts of the other steamers, and also find out what steamers had arrived at Skagway. On October 3rd we reached the mouth of the Hookelinqua River, sometimes called Tes-lin-to, or Newberry River. Here I took the temperature of the water, and found it to be 44 degs. Fahrenheit, which led us to believe that it would be some time before there would be much ice in the river. We arrived at Bennett City on October 5th, and took the noon train for Skagway, arriving there at six o'clock in the evening. The Yukon and White Pass Railway runs between Bennett City and

Skagway over what is known as the White Pass, the distance being about forty miles. This is a narrow-gauge road, and in places has some very steep grades. The road was completed last July. In the fall the company were getting out timber and preparing to build snow-sheds. The single fare on this road from Bennett to Skagway is $10. At Skagway one can buy goods just about as cheaply as at Seattle or Vancouver. You can get a good, square meal for 25 cents. This place has electric light and water works, the water being brought down out of a small lake in the mountains near by, over 1,000 feet high. October 7th we left Skagway on the steamer "Humboldt" for Seattle, arriving there on the morning of the 11th. The trip down was very pleasant, and reminded one of the Thousand Islands. On our way we passed three glaciers. The channel used by the boats coming down the coast is that laid out by the United States Coast and Geodetic Survey, and complete charts are made of the same. On October 17th I left Vancouver, via C.P.R., for Toronto, arriving here on October 22nd, and was glad to get to my journey's end.

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LOW GRADE ORES.

BY H. DE Q. SEWELL, A. M. INST. C.E.

The subject for this paper suggested itself to the author from reading the following extracts from p. 143 of the Seventh Annual Report of the Bureau of Mines, by Dr. A. P. Coleman, on the subject of the West Ontario gold region, where, after remarking that "the number of mines actually producing gold has largely increased," he states: "It must be admitted, however, that several of these mines are producing ore of lower grade than was anticipated," and further on he emphasizes this statement by saying: "On the whole, the conviction is being reached that, in spite of a few fairly rich veins, our gold ores are in general of *low grade*, though often present in amounts extensive enough to justify working on a very large scale. Fortunately all the properties developed except those of Marmora prove to have essentially free milling ores, so that the cost of treatment is reduced to a minimum. As roads and steamboat and railway connections improve the cost of labor and supplies will fall; and ease of access, with a salubrious climate and safety for life and property *must give the region an advantage over most others.*" This statement is fully borne out by the author's own observations during the past eighteen years in Western Ontario, and hence the necessity, when searching for properties likely to develop into paying mines, the general trend in Western Ontario should be to give a preference to low grade veins containing sufficiently large bodies of ore to permit of extensive, and consequently cheaper mining operations from what could be carried out on narrow veins of higher grade ore. Marmora being situated east of Toronto, Dr. Coleman's remarks as to the free milling qualities thus fully applies to the general run of veins in the western section of Ontario. The author's experience of these ores is that about one-third, or 33 per cent., of the gold contained in them is free milling, and that about 77 per cent. of the gold in the tailings can be extracted by the cyanide process; the total saving being equivalent to 84 per cent. of the gold contained in the ore. Thus the subject of *Low Grade Ores*, with its subsequent corollary, *when it will pay to work them*, is an important topic, and one which constantly presents itself to the mining engineer, and through him to the investing public.

The principal requirements for mining low grade ores successfully are: (1) Free milling or partially free milling ore, the residue being capable of extraction either by chlorination or the cyanide process. (2) A large body of ore. (3) Facilities for cheap mining, water powers, etc. (4) Easy and cheap means of communication. (5) Thoroughly testing the vein before developing it into a mine. (6) The erection of a large milling plant and other mining machinery. In this way only can the cost of production be kept down to the lowest possible point per ton that will permit the mine to be operated successfully, and if properly conducted will usually yield greater profits than are likely to be obtained from a narrow vein of high grade ore where a lot of dead or unprofitable rock has to be mined to afford room to take out the ore. This prudence will generally give the preference to a wide vein of low grade ore as more likely to yield permanent and uniform results.

There are also a number of questions of almost equal importance that require to be carefully looked into, such as whether the ore is hard or soft; whether the rock is easily supported or requiring close and immediate filling; the manner of recovering the ore bodies, whether by means of tunnels or through shafts; the quantity of water; cost of timber; cost of labor and supplies; distance from mine to mill; kind of motive power and its cost. These points have all to be carefully considered, and have a direct bearing on the cost of mining.

The reduction of the ore is another and distinct branch of vital importance, and presents a number of conditions that require careful consideration. The hardness or softness of the ore has a direct effect on the crushing capacity of the mill, but large capacity per stamp is not always productive of the best results.

The fineness of the gold or its association with other minerals determines in a large measure the capacity of the mill, and also the extent of subsequent treatment.

To obtain the best results at the lowest cost is the object throughout, and to accomplish this requires a careful consideration of the equipment and methods of mining to be pursued. The ore, having been brought to the surface with as little handling as possible, should go direct to the mill, thus when dumped on the grizzles it should pass automatically downwards by gravity from one operation to another until the pulp passes to waste, after having been relieved of all the precious metal that can be economically extracted from it. In short, success can be obtained in the treatment of *low grade ores* only by the most careful and economical operations, conducted on a large scale, so as to reduce the cost to a minimum. A mine must be made, and it usually requires a large expenditure of time, money and planning to ensure the desired result; but no amount of money or scheming can make a mine where the values do not exist in the ground. Some mines require much less money and time than others to achieve greatness, and in some instances the promoters of mining schemes attempt to *thrust greatness* upon the mines they are endeavoring to sell.

The question of what constitutes the difference between high and low grade is often assumed to be about $20 for high grade, and about $5 or $6 for low grade ores. A comparison of the average values from the principal free milling gold-producing camps shows a total average of $6.53 per ton, from which it is evident that $5 per ton may be considered low grade, and $7 per ton as an approach to high grade ores. New Zealand, which gives the highest average on the list, is one of the smallest producers, whereas the lower grade ores produce by far the largest portion of the world's supply. Comparing these with our West Ontario mines we find:

	Average value of ore per ton.
Mikado, Shoal Lake, Lake of the Woods	$7 00
Sultana, Lake of the Woods	6 00
Regina " " "	6 00
Golden Star, Lower Seine Valley	5 65
Hammond Reef, Upper Seine Valley	3 70
Alice A., Lower Seine Valley	5 60

These values are necessarily liberal, as it is difficult to arrive at exact values. They give an average value to West Ontario gold ores of $5.66 per ton.

The principal low grade ores are the Alaska Mines and the Homestake Mine, South Dakota, U.S.A. The following are the returns for the latter, which employs 540 stamps:

	Averages per ton of ore.
Return from mill, including concentrates	$4 31
Cost of mining, etc	2 73
Net earnings	$1 58

The Alaska Mines are still lower grade, but like the Homestake Mine, they have large ore bodies (practically quarries), which reduces the cost of mining to a minimum, and consequently the profits are enormous The Alaska Treadwell has 660 stamps, the Alaska United 220 stamps, and the Alaska Mexican 120 stamps. The following are their official returns:

Averages per ton of ore.	For year ending May '99. Alaska Treadwell.	For year ending Dec. '98. Alaska United.	For year ending Dec. '98. Alaska Mexican.
Return from mill	$1 76	$2 48	$1 58
From concentrates, mostly chlorinated.	95	1 48	73
Total returns	$2 71	$3 96	$2 31
Mining, milling, etc	1 28	1 29	1 67
Net earnings	$1 43	$2 67	$0 64

The average of these Alaska ores is $3, and they yield an average profit of $1.58 per ton after paying all expenses. These financial results are amply sufficient to prove the great values that have been obtained from them, and also to encourage others to emulate them.

It may be mentioned that in North Mexico the Snodgrass mill, just completed at San Pedro, proposes to mill gold ores that average $2 a ton. They claim to have a large body of this ore, on an acreage of 800 acres, which they have acquired, and from which they anticipate profitable results.

In West Ontario large bodies of low grade ore are not uncommon, but so far little has been done towards their development; in fact, with the exception of the Mikado most of the principal mines come under this category. So far the Hammond Reef and the Alice A. are the largest known bodies of low grade ore. The Hammond Reef is situated on Sawbill Lake, and is 500 feet wide. It has hitherto carried ore worth $3.70 in gold per ton. It costs twenty-five cents to mine and deliver at the mill (the excavation being practically a quarry), and $1.87 per ton to mill, making a total cost of $2.12 per ton, thus leaving a net profit of $1.58 per ton. They have, however, recently put up a forty-stamp mill, worked by electricity, generated by water power, which they estimate will reduce the cost of mining and milling to $1 per ton. If this is accomplished it will raise the net profit to $2.70 per ton, which should enable them to pay handsome dividends. Recent reports from the mine, however, claim that at the depth of forty feet in the quarry that they have reached ore values at $13 per ton. The Alice A. (situated on the Lower Seine valley) claims also to have a vein or reef 500 feet wide, yielding an average of $5.00 of gold per ton. Should they, when operating on a large scale get half these values it should prove to be exceedingly valuable, and would be the means of directing more attention to similar large deposits. The general trend so far has been to develop only the richest veins: these are mostly narrow, and when the ore falls in values or the vein reduces in width, it becomes a burning question as to whether the ore will, after paying the mining and milling expenses, leave any profits for the shareholders. Such a state of affairs, however, is not so likely to occur in a large deposit of low grade ore, for the vein or reef in such cases is usually strong and persistent, and can be cheaply quarried. Should there be a change of values with depth, it may, like the Hammond Reef, be in the direction of higher values, and whilst they last will be of considerable benefit to the fortunate shareholders.

The Alice A. and Hammond Reef are only illustrations of what can be done in Western Ontario. That many other large bodies of low grade ore exist in that district is indisputable, and the author believes that in the near future these and similar large bodies of low grade ore will prove to be the principal gold producers in Ontario. Even in the Transvaal (which before the present war produced 25 1-2 per cent. of the gross gold output of the world), in their principal deep level mines of high grade ores, where they have mills varying from 150 to 200 stamps, the actual amount of gold extracted and profits per ton is anything but high, as the following table, taken from the reports for 1898 of three of their best mines, will show:

Averages per ton of ore.	Crown Deep.	Geldenhuis Deep.	Rose Deep.
Return from mill	$5 52	$6 31	$6 31
Return from cyanide plant	4 54	3 34	4 20
Total returns	$10 06	$9 65	$10 51
Mining, milling, etc	6 42	4 88	5 48
Net earnings	$3 64	$4 77	$5 03

The average of these three mines being $10.07, extracted from the ore at an average cost of $5.59, leaving a net profit of $4.48 per ton. As before stated, the average values in the Transvaal is $7. These mines are considerably above the average, yet it is evident that under existing conditions these mining operations could not well be profitably carried out on a small scale, although, were the conditions more favorable, much lower grade ores would probably be mined. Thus the experience of gold mining all over the world goes to show that the greatest production and largest profits are likely to result from mining large bodies of low grade free milling ores, capable (with the use of modern machinery) of being mined and milled at a minimum cost, thus reducing the risks which are inevitable in mining high grade ores, and ensuring greater security for the capital invested, that should always be the primary object in all mining enterprises.

The editor of the "North American Mining Journal," published in London, England (Mr. Lefroy), gives the following opinion as the result of a visit to the West Ontario gold fields last summer, which, as it fully endorses the author's opinions, may be here quoted, viz.: "As facilities increase, the average value of the ore mined will steadily decrease, while the tonnage will steadily increase, and with the increase of tonnage the aggregate profits will also increase, while the profits per ton will diminish. This decrease will probably be arrested at the point of 4 1-2 dwt. per ton, although in individual cases ore of a lower grade than this may be profitably mined. It may seem an extravagant statement to make at the present time, but it is made with a full sense of what it involves, that the Rainy River district of Ontario has ore enough of this character to make it one of the dominant factors in the gold production of the world, and probably the dominant factor in the gold production of North America." This statement is particularly encouraging, as it appears from recent developments in British Columbia, resulting in the shutting down of the LeRoi, War Eagle and Center Star, that high grade smelting ores cannot be depended on, as their margin of profit is exceedingly low, and consequently the future gold production of Canada will necessarily have to depend largely on the free milling ores of Ontario.

The following is a tabulated list of the gold productions of the world for 1898 and 1899, the latter being approximate:

	1898.		1899.	
	Fine oz.	Value.	Fine oz.	Value.
Africa	3,852,187	$79,624,691	3,648,889	$75,339,851
Australasia	3,013,763	62,294,481	3,777,559	78,082,171
United States	3,148,648	65,082,430	3,506,679	72,483,055
Russia	1,196,634	24,734,418	1,164,603	24,072,344
Canada	662,796	13,700,000	872,227	18,049,593
Mexico	398,487	8,236,720	448,783	9,277,351
India	375,704	7,765,807	411,106	8,498,571
China	321,293	6,641,190	321,293	6,641,190
Rest of the world	1,019,255	21,068,042	1,024,045	21,510,342
	13,988,767	$289,147,779	15,175,184	$313,954,468

The Sawbill Mine's charter of incorporation is dated 26th May, 1896, when the first mining stock of any moment in this country was floated, principally in Hamilton. Up to that date very little work had been done in gold mining in Canada, and what had been was chiefly of an exploratory nature and the gold production very trifling, but now within less than four years' time Canada has become the fifth largest gold producer in the world, which, to say the least of it, is exceedingly encouraging, and bids fair to hold a still more prominent position in the near future. This, however, can only be the result of steady developments, conducted on strictly business principles, chiefly from the careful exploitation of the low grade free milling ores of Ontario.

DISCUSSION.

The President—You have heard this very interesting paper by Mr. Sewell on the development of New Ontario as it is called. Now, I shall be glad to hear discussion from some of the members who are familiar with the subject.

Mr. Aylesworth—I have listened with interest to the paper. I think it will be a good historic record for us to refer to if it be printed in the Report. I would move that this paper be received and printed in the Proceedings.

Prof. Galbraith—I think we ought to be congratulated on having such a paper. Mr. Sewell has evidently gone to a great deal of trouble in working up these statistics, and I have no doubt that they are accurate; and I think that they should be put on record as I have no doubt that they will have a permanent value. I do not know exactly the cost of farming, but it seems to me that possibly the profits to be made out of clay might almost compare fairly well with the profits to be made out of low grade ores; and there is no doubt a very much larger area, so to speak, available for farming than for gold-bearing. I have pleasure in seconding the motion. (Motion put and carried.)

Mr. Lewis—I have listened with a great deal of pleasure to Mr. Sewell's paper on low grade ores. I have had a great deal of experience in mining, and I quite agree with what he says: low grade ores should be mined properly. If they are in large bodies, and they generally have to be in large bodies on the surface to be mined profitably; but you cannot mine low grade ores profitably if you have to do deep mining, unless you have a tremendous ore body. Therefore, if you take a mining proposition in this country or any other country you would have to have a large ore body that you can acquire to make it profitable. That is my experience.

Now, the Alaskan mines have paid larger dividends than others where the ores have been richer, but the ore bodies have not been as large. There is a reference made to them by Mr. Lefroy in the "North American Mining Journal," published in London, Eng.: "I have no doubt, indeed, that they have large ore bodies in the Rainy River district that can be acquired without deep mining." That there is a lot of money in low grade ores is the experience anyway in the United States. In these Alaskan mines there is an immense body of ore; and they simply put in a lot of shafts and throw out tons at a time. When you get down a thousand feet water gets into the mine, which adds to the expense. If you have large ore bodies, and have them practically on the surface, they are better propositions than the richer ones.

The President—It would be much better for the engineers if there were deep mining. Where there is this deep mining and the putting in of shafts and that kind of thing, engineering skill of a high order is required. Some of our School of Science men are now in British Columbia, where that is necessary.

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SYSTEM OF SURVEY.

By S. BRAY, O.L.S.

Ottawa.

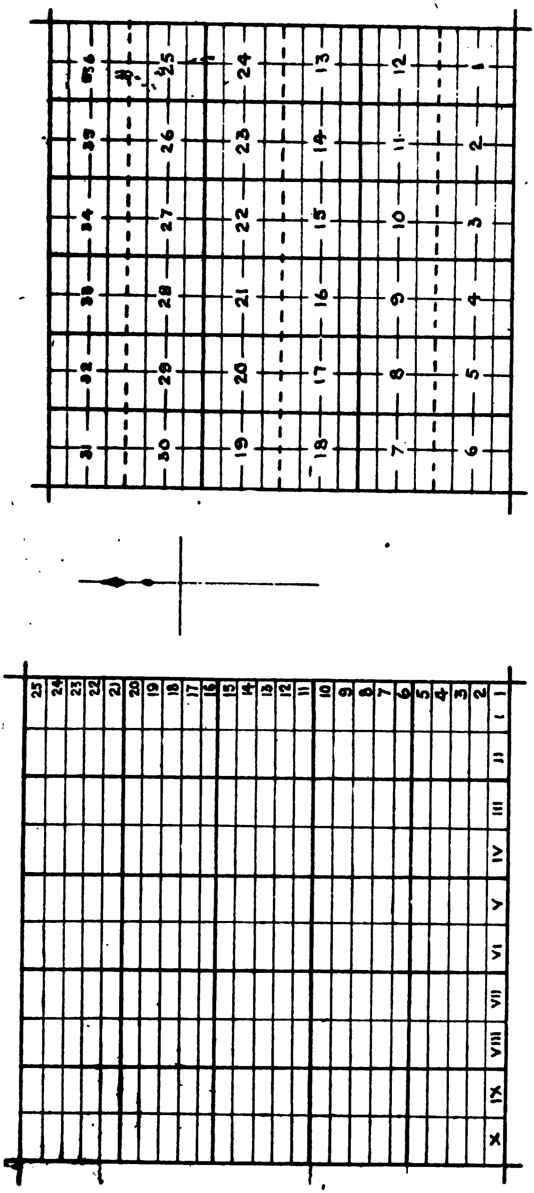
When it is proposed to survey a large tract of land into townships and lots, in order that the land may be conveniently sold, or otherwise granted to corporations or individuals for settlement, the most important point to be decided is the system of survey to be adopted.

The system adopted in the North-west Territories and in part of British Columbia is an admirable one in many respects. I have no doubt all present are familiar with it. Without going into details it may be described as follows: Principal meridians were drawn north from the 49th parallel of latitude at distances apart of about 4 degs. of longitude. Between these at equal distance of 24 miles, base lines were projected in chords of six miles, drawn west along parallels of latitude. From these base lines were drawn meridians at each interval of six miles the outlines of townships, to the depth of two townships to the north and two to the south. Each outline is, therefore, 12 miles long, and terminates in the centre of the space between the base lines. A line called the correction line is then drawn connecting the terminal points.

So far the outline system cannot be much improved on as to subdividing the land by meridians and base lines. The points I would draw attention to are in connection with the interior subdivision of the townships.

The townships are six miles square, and subdivided into thirty-six sections of one square mile, or 640 acres. The sections are numbered from one to thirty-six, commencing at the right hand lower corner of the township, and running zig-zag across it to the top. Each side of every section is also marked with a quarter section post planted in the centre. Lines drawn across the section connecting these posts divide the section into quarter sections of 160 acres.

An allowance for road was made around each section, one chain and a half in width, which was afterwards reduced to one



A Township of 6 miles or 480 chains square divided into double Sections or Blocks of 1280 acres, and half quarter Sections of 80 acres.

A Township 6¼ miles or 500 chains square divided into Concessions and Blocks of 1000 acres, and into Lots of 100 acres.

Scale 200 chs to 1 inch

chain. Each quarter section thus had a road allowance on two sides of it and the owner was liable to be called upon to perform his share of the labor and expense of opening up and keeping in repair one mile in length of road. This was evidently a great tax, besides an apparently unnecessary waste of land. The system was again changed to the one now adopted, under which there is a road allowance of one chain in width around two sections. That is, every block of 1,280 acres is fronted with six miles of road. The long distance of two miles from one cross road to another will probably prove to be a decided inconvenience when all the lands are settled and properly fenced.

The system adopted by the Provincial Government of Ontario in that large tract of land lying between the Ottawa River and the Georgian Bay, south of French River and Lake Nipissing, has many features to commend it. The townships are subdivided into 1,000 acre blocks, and these again into lots of 100 acres each. Each block of 1,000 acres is fronted with five miles of road, and the distance from road to road on each side, the blocks being square, is 1 1-4 miles, or 100 chains. This distance is very convenient, and the tax of keeping up this length of road is found to suit the time and ability of the settlers.

It is to be noted that this system follows the decimal division, which is a decided advantage, whereas the division into sections of 640 acres departs from it.

Again, a quarter section, containing 160 acres, is usually too large an area for one man to cultivate properly. Eighty acres, or half a quarter section, on the other hand, is too small. One hundred acres has been proved by experience to be a very reasonable area to be allotted to one individual.

With regard to the numbering of sections adopted in the North-west Territories, the majority of people, and even surveyors, sometimes find it confusing. One has to keep in remembrance whether the numbers commence at the right or left, and whether at the top or bottom of the township, and that the numbering zig-zags up the township. Anyone not quite familiar with the system, or having constantly to refer to it, usually finds it necessary to construct or refer to a diagram in order to locate any desired section and the sections adjoining it.

In townships which are divided into concessions and lots, the same lot number goes through the whole township in one direction, and the same range or concession number across the township in the other direction. Any desired lot, and the lots adjoining it, can thus be instantly located. It appears strange that this excellent system of numbering, which was adopted for the ranges and townships in the North-west Territories, should not have been adhered to in the numbering of the sections within the townships.

For the purpose of description the subdivision of concessions and lots appears to have a slight advantage. For example, Lot 5, Concession 3, is a little better than the south-east quarter of Section 3. For the purpose of describing a road allowance, or a right of way for a projected road, railway or canal, there is also a little advantage. In the one instance a road allowance across a township is usually described as "the road allowance lying north of Sections 13, 14, 15, 16, 17 and 18"; in the other, "the road allowance between the second and third concessions." Similarly in the case of a right of way for a road, railway or canal; however, it is to be noted that there is no advantage in this respect if the right of way required passes diagonally through the township.

The subsequent cost to individuals of having the lines of their quarter sections or lots defined on the ground by survey is also a matter of consideration. In the case of the system of concessions and lots, when a surveyor is called upon to establish the boundaries of a lot of one hundred acres, he has to run the boundaries on its sides parallel to the governing line of the block, and produce them across the block in order to find their centres. These centres are then connected, making the rear boundary of the lot. This last operation may necessitate the running of a trial line, and a final line of each a quarter of a mile in length. The whole operation consists of the running of three miles of line.

In the case of the subdivision into sections, a surveyor, in order to define the limits of a quarter section, has to run two trial lines and two final lines, each one mile in length, or a total of four miles, or one mile of line more than in the subdivision into concessions and lots. If it should be required to define the limits of an 80 acre lot, or half a quarter section, half a mile more of line requires to be run, making four and a half miles in all.

It would thus appear that a desirable system of survey would be one comprising parts of each of the systems referred to, with the still further improvement of having all lines between lots run due north or south, as the case may be, instead of parallel to the governing line. This practice is now adopted by the Provincial

Government of Ontario in the surveys of the lands within the townships in the tract north of Lake Huron.

The principal meridians would be run, also the parallels of latitude or base lines. The chords would require to be 500 chains long, or rather 505 chains, including road allowances, instead of 480 chains, or 486 chains, including road allowances. The depth from base line to base line would also require to be made to correspond. A township would then consist of 25 blocks of 1,000 acres each, or a total of 25,000 acres, instead of 23,040 acres. Each block is divided into ten lots of 100 acres by lines drawn south from its north boundary, and north from its south boundary to its centre. There would thus be ten concessions in a township, 50 chains deep, numbered from 1 to 10, and 25 lots, 20 chains wide, numbered from 1 to 25.

DISCUSSION.

Mr. Ross—I think this is a very bright, clear and practical paper.

Mr. Van Nostrand—Mr. Chairman, I do not know that there is very much use in discussing this paper in detail. I am sure it is a very useful and valuable paper, and we will all read it when it is printed in the proceedings. When papers are read to us we do not always take them in just at first, and I think we will understand them better and get more good out of them after they are printed. I move that this paper of Mr. Bray's be received and printed in the Proceedings.

Mr. E. D. Bolton—I second that motion.

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SURVEY UNDER SEC. 38, SURVEYS ACT, 1897.

BY G. B. KIRKPATRICK.

Toronto, February 22nd, 1900.

The parties to the action having agreed upon me, and having been appointed special referee under Order of date 20th April, 1899, pursuant to the provisions of cap. 64 of the Revised Statutes of Ontario, 1897, to determine the true definition of the boundary line between the lands of the plaintiff and the adjoining lands of the defendant as described in the patents from the Crown to them, and having made said survey, I thought it would be interesting to the Association of Ontario Land Surveyors to give an account of my proceedings, as the survey was made under a clause of "The Surveys Act" which very seldom occurs in a surveyor's practice, and about which there has always been more or less confusion of ideas.

For obvious reasons I do not give the name of the Township.

I visited the site last summer and made diligent enquiry for any old men who resided in the neighborhood or elsewhere and who might be supposed to know something of the old survey.

Having obtained the names of at least half a dozen old men I visited them in their respective homes, but without eliciting any special information respecting the line in question.

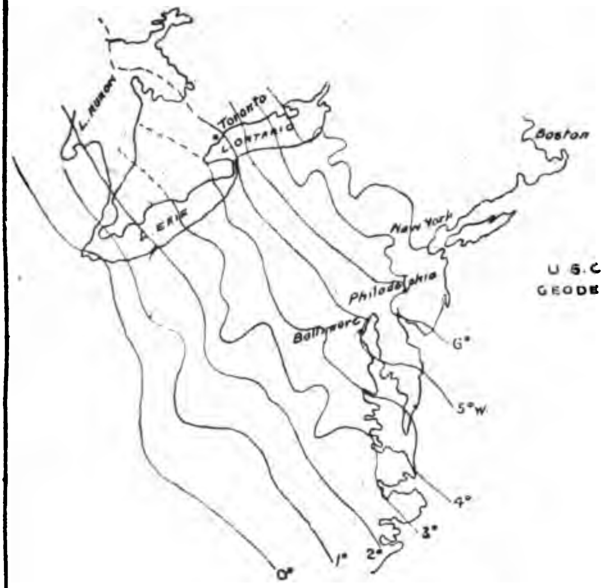
I found from one old man, 82 years of age, that an oak tree had been used by the Boundary Commissioners a number of years before, and that this boundary commission had cut out one of the old blazes and ascertained that it was of the age of Augustus Jones' survey. The old man informed me that a stone monument had been planted by the said Commission a few feet south of the said oak tree; and I find on reference to the Department of Crown Lands that he referred to a Boundary Commission Survey made in 1839, and that the oak tree stood on the west side of lot number thirty-two on the line between the first concession and the broken front of township "*S*". On visiting the spot I found this oak tree in a perfect state of preservation, but the old blazes had grown over. The stone monument, which the old man had informed me he remembered the Boundary Commission had planted, I found in exactly the position he indicated with the letter "B" cut on the top of it. I measured across from this oak tree along the Base line to side road between lots numbers twenty-six and twenty-seven in order to ascertain what the widths of the lots would be and how they would compare with the original survey.

Another old man whom I interviewed, who was also 82 years of age, and who has lived all his life in the vicinity of the survey I had to make, and who is in full possession of all his faculties, gave me a great deal of interesting information regarding the early history of the Township. He described a tree about ten inches in diameter at the time he knew it first, many years before which had blazes on it, but he could not say whether they were made by surveyors or not. Subsequently, however, I found my survey came out very close to the spot pointed out by the old man; and I found that Augustus Jones in 1828 had made a survey of one of the portions of land I was interested in, and think it very probable that the tree mentioned by the old gentleman, referred to this survey and not to the original survey of the Township.

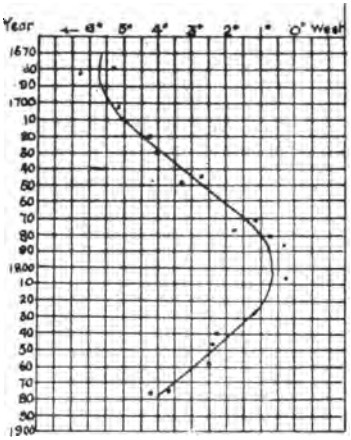
Finding that no reliable information could be got in the vicinity of my work, I turned my attention to searching for old boundaries further south on the line between lots numbers twenty-eight and twenty-nine, and, after diligent enquiry, was informed that there were stone monuments to be found on this line in the third concession and was given the name of a party who could possibly give me some information relative thereto.

I found a stone monument standing at the south-east corner of lot number twenty-nine in the third concession, marked evidently by a surveyor, bearing the following marks—"No. 29" on the west side, and "III" for concession three. The other sides were so weatherworn, portions of the stone having fallen out, I had no means of knowing whether there were any other marks on the monument originally or not.

Extending my enquiries I found that a party residing on lot number twenty-eight in the third concession knew something of the history of this monument. I found him at home and he informed me that he had been born on the lot; that his father had been born on the lot before him; and that his grandfather had owned the lot; and that having lived on the lot all his life he was familiar with the stone monument in question from the



U S. COAST AND
GEODETIC CHART
1890



Secular Variation of the Magnetic Declination, Baltimore Md.
Observed Declinations are shown by dots
Computed " " " " curve

FROM JOHNSON'S SURVEYING PAGE 22

time he was able to run about (he being now 40 years of age). He stated that his father told him this stone monument with three others had been set many years before he was born and had always been recognized as indicating the true limits of the adjoining lots. He also informed me that the side road between lots numbers twenty-eight and twenty-nine in the third concession was in bush when he was a boy and that these monuments had been planted long before the side road was opened up. I obtained his affidavit as to the stone monuments planted at the south-east angle of lot number twenty-nine and at the south-west angle of lot number twenty-eight in the third concession, also as to the position of a stone monument at the north-west angle of lot number twenty-eight, and a stone monument at the north-east angle of lot number twenty-nine in the said third concession; these four stone monuments as he supposed and had always heard having been planted at the same time and by the same surveyor.

After a great deal of difficulty and delay I found an old man, in his 81st year, who was able to give me additional information as to these stone monuments, he being now the owner of lot number twenty-nine in the third concession having purchased it from the descendants of the original grantee from the Crown over 35 years ago. His evidence went to show that for many years prior to the date of his purchase he repeatedly saw a stone monument standing in the position it now occupies at the north-east corner of lot number twenty-nine in the third concession. He had never heard of any dispute as to this stone monument or the other stone monuments already mentioned, and that the owners of the lots had always recognized them as their boundaries.

I also obtained some corroborative evidence as to old stumps, part of the original forest, which agreed with the stone monument in question, showing that, when the survey by which the stone monuments were planted was made, the original forest had been standing, and presumably the marks made by the original surveyor were still visible.

This gave me two undisputed points in the line between lots numbers twenty-eight and twenty-nine, and I found myself then in a position to make the survey.

The original plan and field notes of Augustus Jones are on record in the Department of Crown Lands. Augustus Jones describes how he made the survey. The original instructions are not on record, but Augustus Jones states over his own hand "that he surveyed Townships No. 1 (Niagara) to No. 8 (Barton) under instructions from Alexander Campbell, Esq., Major commanding the 29th regiment at Niagara. That he commenced Niagara 11th June, 1787, and surveyed the Township "*S*" in July, 1788. That when the Townships were surveyed the side lines of the lots were well marked with axes, the blazes on the inside of the trees next to the lines, except the line trees were marked with a blaze and three notches on two sides." By tracing out Jones' field notes I find that he ran the side lines of every lot in the township and that he ran the east limit of every side road allowance down to the lake on a course of north 18 degrees east, running the intervening lot lines up from the lake on a course of south 18 degrees west.

Under cap. 181, Revised Statutes of Ontario, 1897, Section 38, it is provided how surveyors shall act in those Townships in which the side lines of the lots were drawn in the original survey. Going back to the first Act to provide for ascertaining unknown boundaries in all cases in which the concession lines were not run in the original survey:

I find in Statutes of Canada, 20 Vic., cap. 73, page 356, (assented to 10th June, 1857) that the preamble gives a full explanation of the causes which led to the insertion of this Section in "The Surveys Act", which is as follows:

"Whereas the division or side lines of the lots in certain Townships in Upper Canada were drawn in the original survey, and the proprietors of the land have taken possession, and have regulated their improvements by such division or side lines; and whereas under the provision of the Act of 1849 intituled: An Act to repeal certain acts therein mentioned and to make better provision respecting the admission of land surveyors and the survey of land in this Province, Surveyors, in cases of dispute as to the boundaries of lots, are required with the view of ascertaining such boundaries, to measure the true distance along the concession line between the nearest undisputed posts, limits, or monuments and to divide such distance into such number of lots as the same contained in the original survey; but whereas, owing to the incorrectness of the original surveys of the Townships aforesaid, such subdivision does not agree with the division or side lines drawn in the original survey, and consequently the disputed boundaries cannot be decided to the satisfaction of the parties interested, and it is therefore necessary to provide a remedy: therefore Her Majesty, by and with the advice and consent of the Legislative Council and Assembly of Canada, enacts as follows:

"Notwithstanding anything contained in the Act before cited or in any other Act, it shall be lawful for Provincial Land Surveyors, and they are hereby required when called on to determine disputed boundaries in the said Townships, to ascertain and establish the division or side lines of the lots by running such side lines as they were run in the original survey, whether the same were run from the front of the concession to the rear, or the rear of the concession to the front thereof, in the original survey and to adhere to all posts, limits or monuments, planted on the division or side lines in the original survey, as being or designating corners of lots under such original survey",

I have no doubt in my mind that this Act was passed to govern side lines in those Townships from Niagara to Barton, No. 1 to No. 8 inclusive, as so far as I know, there are no other Townships in the Province to which such an Act would apply, these being the only ones I know of in which the side lines were run in contradistinction to the usual practice of running the concession lines in the original survey.

Having, therefore, as before stated, discovered two undisputed points on Augustus Jones' original line on the west side of lot number twenty-eight, in the third concession, I produced the same in a straight line down to the Beach Road along the Lake, then measured easterly along the north limit of the Beach Road, a distance of four chains, being the distance given in the License of Occupation, and then ran northerly, parallel to the above produced original line, a distance of three chains, to high water mark of Lake Ontario, driving in at each end of the said line to within eight inches of the surface of the ground an iron post one inch and a quarter in diameter, three feet long, forged at the top so as to shed the water, pointed at the bottom. and painted red, thus completing the survey in accordance with section 38 of "The Surveys Act of 1897".

An interesting feature in this survey was the comparison of the bearing of the old lines in Augustus Jones' time and the present time, Augustus Jones' survey having been made on magnetic courses.

I find that no observations were made at Toronto until the year 1840 when the variation of the Magnetic Needle was 1° 12′ west. It is now 5° west. I find on the plan of the Boundary Commissioners, above alluded to, dated 1840, that the variation is stated 30′ west.

From the observations in 1840 and 1899 it follows that the annual variation has been 3′.93 westerly.

I find that the earliest recorded observations show that the north end of the Needle was moving east in 1670 and continued to do so until near the close of the Eighteenth Century. From determinations made at Buffalo, Erie, and Cleveland and other places further east, Mr. Stupart, Director of the Meteorological Service, Toronto, calculates that the most easterly declination at Hamilton occurred about 1795 when the Agonic line or line of 0° declination passed near Toronto. In 1788 the Agonic must have passed very near Hamilton and slowly worked eastward until 1795 when it attained its most easterly position passing near Toronto, during which time the Needle will have been moving east to Hamilton. A westward movement then began and in 1800 the Agonic again passed nearly through Hamilton.

From the above deductions it will be seen that in 1788 the declination at Hamilton was 0°, the compass pointed true north.

I find the above to agree exactly with my observations, the course of the side line between lots numbers twenty-eight and twenty-nine being north 22° east, or 4° west of what the compass read in 1788. The variation at Hamilton being 40′ less than at Toronto it follows that the variation is 4° 20′ west showing as close an approximation as the compass of a six inch Theodolite will permit of.

I may say that my survey was promptly confirmed by the High Court of Justice and apparently all parties are quite satisfied.

I append hereto a sketch from the United States Coast and Geodetic Chart, 1890, showing the secular variation at Baltimore from 1670 to 1890, which was kindly furnished to me by a brother surveyor.

DISCUSSION.

Mr. P. S. Gibson—I understand, Mr. Kirkpatrick, that you checked your line with that tree?

Mr. Kirkpatrick—It was practically correct.

Mr. Ross—Mr. Kirkpatrick has given us a peculiarly interesting paper. There are other Townships similar to the ones he mentioned. I know of a county in which the side lines of the first eight lots were run from north to south in the original survey, and some of the lots are narrowed down. In this case the concession lines are crooked, and in some of the townships you could not tell how they were run except that you will find that peculiar shape of lots—lots narrowed down ; the sidelines are straight and the concession lines are crooked. Take, for instance, the Township of Crowland, where for the first eight lots the side lines were run; then on the remaining twenty-five or thirty lots the concession lines were run. I would like to ask Mr. Kirkpatrick: what would be the governing line in this case, the town line nearest to Lot 1, or the last side line run?

Mr. Kirkpatrick—The Niagara District is one of the most difficult places to survey that we have in the province. If any surveys were required now, I suppose that almost everybody would be found to hold their lots by possession. In making the surveys in the Township of Grantham I think Mr. Passmore placed stone monuments, and he measured along the lines as they were run.

Mr. Niven—There were no concession roads run; then the concession lines were established by joining the points on the side roads, so that the concession roads are very crooked. In Niagara I think what they call concession lines were run, and also side lines; there are two lots between every two side roads; then they divide the space between the side roads, front and rear, and join the points. Almost all these townships have a custom of their own. Mr. Kirkpatrick has done well to bring this to our notice, because the system of survey is very difficult to understand. Although in the examinations I notice that nearly all the students that come up can quote the Act as to this system, yet they have not the faintest idea of what it means.

I have much pleasure in moving a vote of thanks to Mr. Kirkpatrick for his paper.

Mr. Aylesworth—I am very glad, indeed, to have heard the explanation of Mr. Kirkpatrick on this part of the Act. I remember when I was practising I was asked what that section meant, and I had to say that I did not know.

The President—This paper of Mr. Kirkpatrick's will be very valuable. As years go by it can be referred to when all these matters have been forgotten. The young surveyor can, by looking over the index, find out what perhaps would have taken him years to find out. Our members might prepare papers on townships coming under their observation in the course of their practice which have peculiarities such as the ones in question.

I have recently made a survey in the Township of North Dumfries. I believe there is no plan on file anywhere showing how the township was surveyed, and I had to enquire a good deal from the oldest residents to find out where the original lines were run. I found that the township was surveyed as a single front township; the lines were run from the front of the concession; previous to that I did not know but that it might have been a double front township, or what it was; but I found that all the original stakes were still there. This is a township that must have been surveyed very early in the century—

Mr. P. S. Gibson—By the Government?

The President—Owned by a private individual, the Hon. Mr. Dickson, and it was sold by him. Some parts of it have remained in that family's hands up to the present day, right where the Town of Galt is situated. I have had to go to considerable trouble to straighten out some plans in the Registry Office that had titles, calling for lots Nos. 10 and 11 in a certain concession, while as a matter of fact these lots were not in existence at all. The owner had laid out sub-division lots fronting on the Grand River; so the titles had to be changed to sub-division lots in this concession instead of the original lots that were supposed by one surveyor to have been laid out, and which must have got into pretty bad shape in the Registry Office. There should be some means taken very soon—the sooner the better—to put these original surveys in better shape, because as time goes on and the old settlers pass away there will be less and less known of the original surveys.

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FOREST TREES OF ONTARIO.

BY W. A. McLEAN.

The professional value of a scientific knowledge of our forest trees has been in past years discussed by the Association, and the subject of "Botany and Forest Flora' has been placed on the list of subjects for examination—this largely for the purpose of requiring such an acquaintance with our forest trees as will enable the surveyor to name them correctly.

I have assumed, correctly I have no doubt, that most of you know more about the subject than, perhaps, you are aware, and that a brief outline of the trees of the Province will merely convey to you the information that you know it all, which of itself will be of some value. At any rate, in the great majority of cases there can be little doubt as to the genus to which the tree belongs; that is, whether it is an ash, oak or elm, although there may be frequent uncertainty as to the species.

Again, while we may, without much uncertainty, be able to properly name the majority, there will be an element of safety in a doubtful case if we can classify the tree not merely because of its own characteristics, but as well because we know that it cannot be anything else, which is possible only when we have a knowledge of all the trees it might be.

The list of native trees is not a very lengthy one, but may be found difficult to prepare from the sources available. Transition from the herb to the shrub and from the shrub to the tree is so gradual that the botanist is forced to disregard the distinction in his primary classifications, and so dependence is placed on the flower and method of seed production. So it is that we find, in the botanist's classification, trees obscured among a mass of herbs and shrubs. The nettle is placed beside the elm, the strawberry is in juxtaposition to the black cherry; and a mass of herbs and shrubs intervenes. There are no distinctly Canadian or local text-books on forest trees alone, and general works are apt to be confusing, including as they do many trees which do not grow in this Province.

The most practical means of distinguishing trees are found in the leaf formations, the bark, the fruit, the size and general aspect of the tree. The leaves vary as to size, shape, texture, color; some are smooth, some are rough, downy or hairy, and the margin may be entire, toothed, wavy, regular or irregular, and many other forms. The bark varies as to color, thickness; it may be smooth or rough in different ways, and sometimes has a characteristic taste or odor. The fruits and the size and aspect of trees of different species exhibit equally numerous variations. It should, however, be understood that none of these characteristics are constant for every tree of a particular species. There are exceptions to many, if not all, rules, even in botany. The comments which accompany the list indicate the most prominent distinguishing marks having reference to other trees with which they are likely to be confused, and from a practical standpoint.

In order to obtain a completely satisfactory knowledge of forest trees some acquaintance with botany is necessary. Otherwise one's knowledge and the use to which it may be put must remain very local, and cannot be carried to other countries. For example, I may point out that of some 109 coniferous trees native to the United States, eighty are found west of the great plains, twenty-eight belong to the eastern forests, and only one is common to both. But with or without an acquaintance with botany, a study of our own trees, and consultation with available works on the subject, will be much simplified by having a complete, or approximately complete list of the trees we may expect to meet. A knowledge of such a list as follows may be had without much, if any, study of botany, but in extending our knowledge to shrubs, herbs, and to the trees of other countries botany is the only convenient medium.

The most important timber trees of the Province are contained in the botanical order *Coniferae*. This is the single Canadian order of a class in which the ovules and seeds are not enclosed. It includes all of the cone-bearing trees, and there is but one species, that a shrub, which cannot be described as cone-bearing. The trees of the order are:

Pinus Resinosa (Red Pine).
Pinus Strobus (White Pine).
Pinus Banksiana (Jack Pine).
Abies Nigra (Black Spruce).
Abies Alba (White Spruce).
Abies Canadensis (Hemlock).

Balsamea (Balsam).
Larix Americana (Tamarack).
Thuja Occidentalis (Arbor Vitae, or White Cedar).
Juniperus Virginana (Red Cedar).

The pines may be best distinguished by their needles or leaves. The white pine has five in a bunch, from three to four inches long. The needles of the red pine grow in pairs, but are five to seven inches in length. In the jack pine the needles grow in pairs, and are scarcely an inch long. At a distance the red pine has a sharper outline than the white pine, while the bark has a ruddy cast. The jack pine has a stunted appearance, is often scarcely more than a shrub, and rarely attains a height of thirty feet.

The spruces may be distinguished from other evergreen trees by their short, four-sided leaves, pointing in all directions. Leaves of the white spruce are curved, rather slender, and of a bluish green. Leaves of the black spruce are generally straight and stiff, and of a darker green than those of the white spruce. The bark of the black spruce is also darker than that of the white spruce. The cones of the black spruce are a broad oval, while those of the white spruce are not so thick in proportion to their length.

The Hemlock has blunt, flat, short (about one-half inch) needles, a dark, lustrous green above, and whitish beneath. Its boughs spread out, plume-like, drooping, while the cones are very tiny.

The Balsam has slightly longer leaves than those of the Hemlock. They are flat, blunt, straight, a dark-blue green above and lighter below, and grow in two directions from the branch. The small branches are opposite one another, and make an angle of 45 degrees with those on which they grow. The cones are two to four inches long, and the bark is marked with blisters containing the well-known balsam.

The Tamarack may be known by a glance at the ground beneath it, which will be thickly carpeted with the brown deciduous leaves. The leaves grow in bunches along the stem, and the cones are very small. The tree has an extraordinarily tall and thin appearance.

The cedars are found chiefly in southern Canada. White cedar has a bright green leaf spray, and the fruit a cone. Red cedar is dark-hued, compact, the leaves smaller than those of white cedar, and the fruit a bluish-gray berry.

The order *Salicaceae* includes the willows and poplars. Of willows there are some eight well-defined species, but there are so many hybrids, and so many have been introduced from Europe, that they are difficult of classification. They are unimportant as trees, although one or two varieties occasionally reach a height of twenty or twenty-five feet, but they may generally be classed as shrubs. With the exception of one species they are generally found in moist or boggy land. Their narrow leaves and slender branches are distinctive. One variety, salix alba, or white willow, is of foreign origin, but has become so common that we may almost consider it naturalized.

The more important trees of the order are the poplars, which are :

Populus tremuloides (White Poplar or Aspen).
Populus grandidentata (Large-toothed Aspen).
Populus balsamifera (Balsam Poplar).

The aspen, or white poplar, may be recognized by its tremulous foliage, due to the thin, flattened leaf-stems. The leaf of the white poplar is smaller than that of the large-toothed aspen, and is slightly heart-shaped; and the bark is smooth and greenish white. The leaf of the large-toothed poplar has, as the name indicates, its margin more prominently toothed, and the outline is more of an egg shape. The bark is inclined to be darker and rougher than that of the white poplar, and on the young branches is quite dark. The white poplar may readily be mistaken for the gray or white birch, but the birch has an exceedingly brilliant light green foliage, which reflects the sunlight, while the aspen has a whitish foliage, which is not at all shiny. The leaf of the balsam poplar is very different from that of the other two. The leaf-stem is thicker, so that it does not tremble, and the leaves, which are firm and thick, are held erect on the twigs. Their color above is a yellowish green, although whitish below like the other poplars. The buds are gummy, with an agreeable balsamic odor. A number of European poplars have been introduced, which have become very common, notably the silver-leafed poplar and Lombardy poplar.

The order *Betulaceae* includes four well-known trees:
Betula lenta (Sweet, Black or Cherry Birch).
Betula lutea (Yellow Birch).

Betula papyrifera (White Paper or Canoe Birch).
Betula populifalcia (White or Gray Birch).

The first of these, black birch, has a brown bark, and the twigs have a pleasant aromatic flavor that is sufficiently distinctive. The yellow birch has an unmistakable yellowish cast that prevents its confusion with other varieties. The outer bark curls up in thin, satiny tatters, giving the trunk a slightly ragged appearance. The white birch has a distinctly light, airy appearance, and in the sunlight the leaves reflect a dazzling brightness. Under each bough where it joins the trunk there is a characteristic triangular brown patch. The white bark does not easily separate into layers, and, unlike the canoe birch, is apt to be knotty. The canoe birch is well known by its bark, so easily separable into large sheets unmarked by knots. It need not be confused with the white birch, as the trunk is scarcely marked with the triangular patches to which reference has been made, while with the white birch they are never absent. The bark of all members of this order has a characteristic dot and line marking.

The order *Cupuliferae* is prominent, including the several species of oak, chestnut and beech. The cup or burr which surrounds the nut is a prominent characteristic of the order, the trees of which are :

Quercus alba (White Oak).
Quercus macrocarpa (Burr Oak).
Quercus bicolor (Swamp White Oak).
Quercus rubra (Red or Rim Oak).
Quercus coccinea (Scarlet Oak).
Quercus coccinea, var. tinctoria (Black Oak).
Castanea vesca var. Americana (Chestnut).
Fagus ferruginea (Beech).
Ostrya Virginia (Ironwood or Hop-Hornbeam).
Carpinas Americana (Blue Beech or Hornbeam).

The oaks are difficult to classify owing to the presence of a number of hybrids, and also the importation of European varieties. Those enumerated are probably the only distinct varieties found in Ontario. The acorns of the first three mature in one year, those of the three last varieties maturing in two years.

The chief distinctions are :

VARIETY.	LEAF.	BARK.	ACORN.
White Oak....	Rather deeply lobed, turning to rich red in autumn.	Grey, not very rough, tinged with brown.	Rough, cupped, generally in pairs.
Burr Oak	Deeply lobed and very long, turning dull yellow in autumn.	Deeply furrowed, young branches marked with corky ridges.	Heavy fringe at edge of cup. Usually solitary.
Swamp White Oak.........	Wavy outline, resembling that of chestnut, yellow in autumn.	Flaky bark, and small, crooked branchlets hanging from heavy limbs.	Rough, rounded cup, with a bristling, rather than fringed, edge, frequently in pairs on a long stem.
Red Oak	Bristle-tipped, turning a dull red in autumn, not deeply lobed.	Dark gray-brown surface of scaly plates.	Saucer shaped, not large.
Scarlet Oak ...	Deeply rent, having a ragged appearance, red in spring, green in summer, turning to red in autumn.	Thick, brownish, roughly seamed.	Thick, top-shaped cup, covering one-third of nut.
Black Oak	Deeply incised, turning to rich red in autumn.	Dark, often blackish.	Acorn small, but very yellow.

The beech and chestnut are too well known to need description. The hornbeams are apt to be confused with the beech, but are smaller trees with furrowed trunks and a different fruit. The blue beech has a greyish blue smooth bark, often marked by perpendicular ridges. The fruit is a nut, protected by two small three--pointed leaflets placed base to base The hop-hornbeam has a fruit resembling the hop, the bark is rather rough, a brown or dark grey, and is finely furrowed up and down, with the ridges broken into three and four inch lengths.

The order *Juglandaceae* is well known, comprising :
Juglans cinerea (Butternut).
Juglans nigra (Black Walnut).
Carya alba (Shell-bark Hickory).
Carya tormentasa (Black Hickory).
Carya porcina (Pig-nut Hickory).
Carya microcarpa (Small-fruited Hickory).
Carya amara (Swamp Hickory).

The butternut and walnut may at once be distinguished by the nuts; also by the petioles (or leaf stems); these in the former case being very sticky, with a horse-hoof base, and in the latter slightly downy, one to two feet in length, and without the horse-hoof base.

The shell-bark hickory, the most common of the genus, may be known by its gray, loosely-attached bark hanging in strips a foot or so long and six inches wide. The leaflets on a stem are five in number. The husk of the nut is thick and hard, and splits into four separate sections. Black hickory (C. tormentosa) has from seven to nine leaflets on a stem. The nut is large, fragrant when bruised, thick shelled, with a thick husk, but the kernel is small. Pignut hickory (C. porcina) has from five to nine leaflets on a stem. The fruit is sometimes pear-shaped, otherwise oval, and has a thin husk which clings to the nut, falling with it to the ground. The small fruited hickory has a small round nut free from angles, with a thin husk which splits open almost to the base. The leaflets are usually five, sometimes seven, on a stem, and the bark is rough, separating into thin, narrow plates. Swamp hickory has from seven to eleven narrow leaflets on a stem. The husk, enclosing a rather soft, roundish nut, is thin, and separates only half way down. The kernel, at first sweet, becomes exceedingly bitter.

The order *Platanaceae* is represented by one species, Platanus occidentalis, the plane tree, button wood or sycamore, a handsome tree, found only in south-western Ontario.

Of the elms belonging to the order Urticaceae (the nettle family), sub-order Ulmaceae, there are two varieties:

Ulmus fulva (Red or Slippery elm).
Ulmus Americana (White or American Elm).

The former is a medium-sized tree, with leaves very rough above and taper-pointed; the latter the larger and more handsome of the two, with arching branches, smaller leaves, smooth above and abruptly pointed.

The order *Lauraceae* is represented by one variety, Sassafras officinale, a tree of moderate size, growing in southern and western Ontario, which may be known by its strongly aromatic flavor.

The Olive family, order *Oliacea*, has three representatives:

Fraxinus Americana (White Ash).
Fraxinus sambucifalia (Black Ash).
Fraxinus pubesceus (Red Ash).

The first two may be distinguished from one another by their leaflets, those of the former having stalks, and those of the latter being sessile. The first two have smooth, glaborous petioles and branchlets, while those of the last (red ash) are covered with a soft down.

The Cornus florida, or flowering dogwood of the order *Carnacea*, is a small tree found in south-western Ontario. Farther south it increases in size, and is one of the woods known as boxwood. The flowers are large, dull white, the leaves from three to five inches long, and the fruit a bunch of bright red berries.

Of the order *Magnoliacea* there is one species in Ontario, the tulip tree (Liriodendron tulipifera), a tree found in the western peninsula, and assuming very stately proportions. The leaf is cut off in a peculiar manner at the end, by which it may at once be recognized.

There is but one tree of the order *Rosaceae* (Rose family) deserving of classification among timber trees, yet there are other small trees, at times little better than shrubs, which may be enumerated. The trees of the order, then, are:

Prunus serotinta (Wild Black Cherry).
Prunus Pennsylvanus (Wild Red Cherry).
Prunus Virginiana (Choke Cherry).
Prunus Americana (Wild Plum).
Crataegus coccinea (Scarlet-fruited Thorn).
Crataegus tormentosa (Black or pear thorn).
Crataegus coccinea (Dotted-fruited Thorn).
Crataegus crus-galli (cockspur thorn).
Pyrus coronaria (American Crabapple).
Pyrus Americana (Mountain Ash).
Amelanchier Canadensis (June Berry).

The one important tree of this order is the wild black cherry, to be distinguished by its size, its small black fruit, and the bitter almond flavor of its bark. The choke cherry is but a good-sized shrub, and the fruit is very astringent. The red cherry has a very sour fruit, but otherwise resembles more the garden cherry. The bark, like that of the garden cherry, has swollen, rusty-colored spots, and usually strips around the trunk. The wild plum has a yellowish orange-colored fruit, oval in form, a thick acid skin and pleasant flavor. The thorns are somewhat without the limits of this paper, as they are unimportant and scarcely more than shrubs. The remaining trees of the order are well known, and there is not likely to be any doubt as to their identity. Except, perhaps, the June berry, a tree somewhat resembling the black cherry, except that it is never more than thirty feet high, is slender, drooping, and has a sweet, purplish fruit, ripening in June.

The maples belong to the order *Sapindaceae*, and there are five species of importance:

Acer saccharinum (Sugar Maple)
Acer rubrum (Red Maple).
Acer Dasycarpum (White or Silver Maple).
Acer Pennsylvanicum (Striped Maple).
Acer spicatum (Mountain Maple).

The last of these is a shrub, growing in clumps on low grounds. The first two have leaves three to five lobed, the lobes of the sugar maple being rounded, those of the red maple being sharp pointed. The twigs of the red maple, too, are of a reddish hue. The leaves of the silver maple are deeply and sharply five-lobed, and silvery white beneath. The striped maple has a light greenish bark, with dark vertical lines ; is a small tree, seldom growing over twenty feet in height, the leaf being large, thin and three-lobed at the apex. In addition to the foregoing species a few others are sometimes met in cultivation.

Basswood or whitewood belongs to the order *Tiliaceae*. The one Ontario variety is Tilia Americana, which is a very handsome, straight tree, the large, strikingly heart-shaped leaves (four to six inches long) being a sufficient means of identification. The fruit is distinctive too, resembling a bunch of elongated brown peas. Another species, Tilia pubescens, a small-leaved basswood, may be looked for in Southern Ontario.

Of the locusts, order *Leguminosae*, there are two varieties:
Robinia pseadacacia (Common Locust).
Robinia viscosa (Clammy Locust).

The latter is the smaller of the two trees. The chief distinction is that the leaf stems and branchlets of the clammy locust are sticky, and the flowers erect, rose tinted, and scarcely fragrant. The branchlets and leaf stems of the common locust are not sticky, the flowers are drooping, white and very fragrant.

The staghorn sumach (Rhus Typhina), order *Anacordiace*, is so well known as to need no description. To this order belong poison ivy and one or two other shrubs found in Ontario.

Other trees, small and unimportant, which we may expect to meet are:

Celtis occidentalis (or Sugarberry).

The fruit of sugarberry is single seeded, sweet, about the size of a currant, purple when ripe, and solitary on a long stem in the axles of leaves; tree from a shrub to fifty feet.

Sweet ruburum may be known by its blue-black, sweet fruit, growing in clusters and ripening in autumn.

Viburnum lentago (Sweet viburnum).

Negundo aceroides (Box Elder or Ash-leaved Maple).

Morus rubra (Red mulberry).

The foregoing list of sixty-eight species includes the principal trees of the Province. There is, as I have said, no well-defined line of demarcation, however, between herbs and shrubs, shrubs and trees. In consequence I have no doubt included some varieties which scarcely deserve to be classed with the forest trees, and have no doubt omitted some which, in importance, are equally deserving of mention. There has been method in the madness, however, and I have endeavored not to trespass except where it has seemed advisable for a clearer identification of the trees of importance.

A discussion of the distribution of these trees would fill a volume, but may be here briefly noted. Beginning with the most northerly portion of the Province, bordering on James Bay, we find little but spruce and balsam poplar. Further south the first additional trees we meet are the jack pine and the aspen (populus tremuloides). Further again, and we are among the forests of white pine, red pine and hemlock; and our next step brings us well among the broad-leaved trees, the oaks, maples, elms and beeches, till at last, in the most southerly portions of the Province, we are among trees of an almost tropical aspect, the tulip tree, sassafras and sycamore. Were we to continue our journey still to further south, the task of merely studying tree names would increase many times. So that if we have not the great variety of trees to be found in the Southern States we are spared the labor of making their acquaintance; and with our immense areas of pine, spruce and hemlock there is none we need envy.

The title selected for this paper suggests a distinction. At some risk let me point out that "forest trees" is but a branch of "forestry." The former is but the gateway to the other—to a very wide but interesting field. The latter and broader scope has been brought before the Association in several valuable papers by Mr. Southworth, Director of Forestry.

While the more prominent characteristics of the different trees have been stated, there are many others which could not find place in so brief a paper. The literature of trees is, however, a very wide one. In continuing a study of Ontario trees, the works which have appeared to be most serviceable are: "The Trees of North-eastern America," by Newhall, and "Familiar Trees and Their Leaves," by Matthews. An introduction to botany may be had by reading a few chapters of Spotton's "Botany." The subject of Forestry in its economic aspects is being fully discussed from time to time in the reports of the Ontario Bureau of Forestry; and I may suggest "North American Forests and Forestry," by Bruncken, as a very readable and recent book on the question.

[*This Association is not responsible as a body for the opinions expressed in its Papers by Authors.*]

ARTESIAN WELLS.

BY A. J. McPHERSON.

There has always been a certain amount of mystery in the popular mind connected with the location and movements of underground water and we have all observed with what reverence one of those old diviners is held as he goes about with a forked branch of a tree until he finally stops at the place where he pretends is the proper spot to look for water. The wizard-like abilities of Major Girouard could not be regarded by the natives of an Egyptian desert with more superstition as he constructed his line of railway and obtained water at suitable intervals simply by putting down wells where for ages there was nothing but a sandy waste. When we come to consider the conditions under which these supplies of water exist, however, all this mystery disappears and, at the present time, it can be told with certainty in many cases what sort of water supply may be had from these sources.

There are two classes of water from which our Ontario Towns and cities generally obtain and look for their water supply. Those on the shores of our Great lakes and rivers naturally go to these reservoirs and the only difficulty is to find the place where the water can be obtained pure and unlikely to be contaminated in the future.

Inland towns must look to underground sources and to lakes and streams fed by underground sources for their supplies. Most of the rivers in Ontario are short and the lands around their sources have been denuded of their forests so that they have become very small streams in comparison with what they once were, except when a heavy rainfall occurs or during the spring freshets when they suddenly become roaring torrents with muddy water carrying all sorts of debris and often doing great damage along their banks.

The dry weather flow of these streams is almost all kept up by the many springs running into them along their banks and where the beds of the streams are so high as to be above the lowered ground water they dry up altogether during this season. As these rivers are becoming more and more polluted wit sewage and waste matters, for which they are often considere the natural means of disposal, they cannot be taken as a sourc of water supply.

The first source from which villages and towns usually obtain their domestic water, and on which many of the smalle towns still depend, is the old fashioned pump and well, dug o drilled to the necessary depth to act as an accumulator from th immediately surrounding district. As the area gets built upo and population increases these wells become little better tha cesspools into which the waste matters of the district mus drain and to which can be traced many of the epidemics o typhoid, scarlet fever, and other preventable diseases. Any flo of water depending on a small drainage area, as in the case o these wells, must of necessity be limited in quantity and man of them dry up annually and cannot be depended upon for a suppl throughout the year.

A very prevalent opinion is that in sinking a well one mus go down to the level of a lake or some stream but so far fro this being the case, as was noted above nearly all these lakes and streams are fed by springs which are nothing more tha the outcrops of underground reservoirs and if a stream or pon does not dry up at any time during the year water ought to b found at some distance above this level in the surroundin district, the farther away, depending on the strata, the highe above this level.

In a section of the Wisconsin Experiment Station in a sandy clay and clay loam with boulders interspersed, the ground wate surface during, a time when there was no extraordinary rainfall, was found to have an upward grade away from the lake into which they naturally discharged, of about 1 in 16 so that at a distance of 200 feet from the lake the ground water surface was 12 feet, and at a distance of 1200 feet it was found to be 52 feet above the lake level, the latter giving a grade of about 1 in 23.

This ground water surface rises and falls as the rain fall is great or small and acts as a regulator for the springs supplied. In an experiment noted in the nineteenth Annual Report of the United States Geographical Survey, columns of sand 8 feet high with sand grains of different sizes, after having been put in an apparatus designed to prevent evaporation, were saturated and allowed to drain with the following results:

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Amount of run-off.	From sand.	Was per cent. of the weight of the dry sand.
For the first nine days	No. 20	14.98
" " "	No. 100	8.42
After nine days till two and a half years	No. 20	1.61
	No. 100	1.26
Amount retained after draining, two and a half years	No. 20	4.24
	No. 100	11.82
Total amount when saturated	No. 20	20.83
	No. 100	21.50

NOTE.—No. 20 sand is sand that will go through a No. 20 Sieve, but not through No. 40. No. 100 sand is sand that will go through a No. 100 Sieve.

The lower foot of both the No. 20 and No. 100 columns were almost saturated at the end of two and one-half years while the surface foot of the No. 20 sand retained about 0.25, and of the No. 100, 3.5 per cent. of the dry weight showing them to be very dry indeed.

This experiment well illustrates the capacity of soils for retaining moisture and of allowing a slow seepage to take place thus giving a constant flow to springs and underground supplies. Clay loams and clays retain their water much longer than these sands as we would expect when it is stated above that the fine sand acted thus, and consequently produce a more constant seepage.

An idea of the amount of water that is stored in these reservoirs may be had by considering the following:

When below the drainage outlet, and hence saturated, 12 inches of

Marly loam was found to contain	5.88 inches of water.
Red Clay " " "	5.07 " "
Sandy Clay " " "	4.67 " "
Fine Sand " " "	3.76 " "

Except in the very driest times soils and rocks contain about 75 per cent. of the amount required for saturation when below the surface more than 4 or 5 feet, even when considerably above the ground water level.

In Ontario the rainfall may be taken to average from 30 to 40 inches annually.

About 50 per cent. of this amount will generally evaporate or run off on the surface while the remaining 50 per cent. will sink into the soil, some of it to be taken up by the roots of plants, some held in the ground by capillary action until it evaporates or is taken up by roots, and the remainder goes to swell the ground water reservoirs.

Assuming 25 per cent. of the rainfall to sink to these ground waters or about eight inches annually one acre will provide a daily flow of 181,500 Imperial gallons and when we remember that the configuration of the ground enables areas some-times miles in extent to minister to the supply of a few springs it is not surprising that they give a large and never failing quantity throughout the driest seasons.

Many towns develop these outlets in various ways by collecting the outcrops in galleries or wells from which they may be led or pumped as required.

Guelph, Orangeville, Owen Sound, N. Toronto, Galt and other places obtain their water in this way. When a permeable sand or gravel occurs over a wide area and the strata are found to dip, as they generally do, in many cases we will find on their lower reaches an impervious or comparatively compact deposit on top and if the upper layer is pierced by a drill hole the water is shown to be under pressure and will rise above the surface or near the surface above the level of the ground water. A number of towns have availed themselves of these conditions and have abundant supplies of water as the result. These waters are drawn from a wide drainage district through channels that are partly capillary and partly obey the laws of flow, in larger than capillary channels for long distances, and hence are absolutely pure from a sanitary stand-point. They are found sometimes to be objectionably impregnated with mineral matters or so hard as to require treatment before becoming a good commercial water. Aerating in all cases is necessary and is generally all the treatment required. Data from towns supplied in this way from sources that are not down to rock-level.

PLACE:	Depth of Source: Feet.	Water rises to above or below surface.	Bore of well. Inches.	Quantity available: Imp. gal. per hour:	Material drilled through.
Essex..........	112, 135	25 ft. below surface.	5 and 8	1,500	Clay 100 ft. hard pan, 3 or 4 ft. coarse gravel, rock.
Leamington.	50	10 ft. above	8	....	10 ft. of sand and clay, sand and clay to gravel:
Shelburne....	450	50 ft. below	5	....	100 ft: quick-sand, clay and marl to water at rock.
Barrie.........	125	12 ft. above	4	1,440	20 ft. sand, 60 ft. sand with thin layers hard pan, 3 or 4 ft. hard pan gravel:
Newmarket..	150, 265	Above and flow into well	4, 5 and 6	500, 1,250	Hard pan and quick-sand to water-bearing gravel.
Berlin.........	116	7 ft. above	8	2,000, 6,500.	145 ft. sand and clay, 5 ft. hard pan, 8 ft. gravel; varies in ten wells from this slightly.

A well sunk by Mr. Savage in Berlin showed the surface to be 187 feet above lime-stone rock.

In every case the water bearing stratum is loose gravel or sand. In 1895 the Town of Galt deemed it prudent to increase their supply and drilled through lime-stone rock from the surface to a depth of 140 feet when they encountered a very porous and much fissured lime-stone which yielded from a 6 inch well about 100,000 gals. per diem. at the surface of the ground. This water would rise about 3 or 4 feet above the surface to a point a little below the outcrops of the lime-stone rock along the sides of the Grand River Valley in which the pump house was situated, the springs which were developed as aforesaid outcropping at the surface of this rock and being collected in a well convenient to the pumps. In 1896 another 6 inch well was put down and a similar quantity of water was obtained at about the same depth in a similar rock. This rock was penetrated about 40 feet further, 30 feet of which was water-bearing and the flow from the well was by this means increased to about 300,000 gals. per diem. and the water would rise above the surface to about the same height. These wells would appear to be fed from an area where this fissured stratum came to the surface or where it might receive the ground water through the surface deposits on top of the rock, and received the pressure sufficient to raise them above the surface by having superimposed layers of more compact lime-stone above the water-bearing stratum. The temperature of the water discharged from the wells is 46° and that from the springs 48°. The former remains constant while the latter will lower about 1 degree during March and April.

In 1899 a well was dug in the same vicinity with the object of getting sulphur water, to a depth of 200 feet or more but as it was commenced nearly as high as the rock outcrops along the valley the water obtained would not rise above the surface.

St. Mary's derived a supply in 1899 by drilling in lime-stone of similar formation to that of Galt.

At Preston sulphur water is met with and will flow out above the surface from a depth of about 120 to 150 feet below the surface of the rock.

There have been practically no explorations for water in the lower rocks although quite a number of wells have been sunk in different parts of the Province for salt, oil and gas.

At a well sunk at the London Asylum the following is the record of the drilling:

	Feet.
Surface	130
Corniferous limestone	200
Guelph and Niagara (Onondaga) limestone	970
Salt and Shale (Onondaga)	100
Black Shale (Clinton)	200
Red Shale (Medina)	500
Hudson River limestone and shale	150
	2,250

As nearly all these formations are lime-stone which are very poor water carrying media, except when very porous, the most successful explorations for water appear to have been made and would be most likely in the upper strata or within the surface deposits while by boring deeper we are likely to get water tinged with salt or some other minerals in the Western peninsula of Ontario.

Two sections across the Western peninsula, as given in the Annual Report of the Geological Survey, Vol. 5, 1899-'90-'91, and which were made from observations collected from a large number of salt, oil and gas wells sunk in different parts of the district, admirably show the strata underlying this portion of the Province.

The conditions are such that we might expect water to flow to the surface from porous strata of lime-stone or sandstone in the district west of Strathroy while east of this the water would not come to the surface unless in the comparatively deeply eroded river valleys that sometimes cut considerably into the rock strata.

The great depth of the surface deposits over much of the Province seems to indicate, however, that they are the most promising field of exploration for potable water that may be used for commercial and domestic purposes and they certainly contain an inexhaustible supply in places where it can be made available.

It is with considerable diffidence that the foregoing is submitted as I find that the subject is practically an unexplored field and there is very little literature or data that will apply to the Province. However, there may be a number of the members who are interested in the subject and may have made a study of it and I may look to them to criticize and correct any statements that may seem to be not borne out by the facts.

DISCUSSION.

The President—As Mr. MacPherson states, I think this is one of the first papers to deal with artesian wells as occurring in this province, or rather dealing with the development of underground waters. It is mentioned in the paper that the Town of Berlin has an artesian well water supply. The original water supply there was a little pond, which was very soon dried up, and since that time about a dozen artesian wells have been put down, most of them eight inches in diameter, going down an average of 150 feet without reaching the rock. At this average depth water was struck in gravel, and would rise as stated about seven feet above the surface of the ground, and in that way a limited water supply has been secured for the Town of Berlin, with a flow from the wells of about 700,000 imperial gallons per day, which just about supplies the needs of the town at present except in the summer time. I do not know what we will do next summer; probably we will have some more wells by that time. In the Town of Waterloo adjoining they have secured an ample water supply. Of course, as it was a smaller town their needs are not so great, but by putting down three seven-inch pipes about 100 feet in depth they have secured upwards of half a million gallons per day of very good drinking water. This book that I have here shows one of these wells a few minutes after being struck; and that is right in the heart of the town. It illustrates the point that engineers should not begin any extensive water works investigations before they put down a pipe to test whether they have not right in the heart of the town a better water supply than they can get by going miles out.

Mr. MacPherson spoke of the artesian well water that they have got in Galt. At one time it was recommended by the engineer they employed to report upon water supply, to go out to a lake about three miles from the town, which would entail an expenditure of about $10,000, I think, at the lowest calculation, and this was avoided by digging a hole right at hand at a very small cost, comparatively speaking ; and they got the water at their pumping station. Engineers in the future will be looking to the best interests of the municipality employing them if they will request them generally to put down an artesian well. Of course, I do not mean where they have the great lakes to draw upon that they should spend money in this way, but where there is no water supply close at hand you don't know what you might strike 100 or 200 feet below the surface.

Mr. Van Buskirk—I am rather surprised at the President making a statement that this is the first paper on the subject of artesian water. I think I recollect a gentleman, who belongs to the Association, reading a paper after having collected information on the subject, and who has probably more to say on this matter than any of us.

I do not altogether agree with some of the remarks of the President on the question of advice to the municipalities, because there are many places where the artesian water is not by any means as good as the water on the surface, not only for the purpose of domestic use, but especially for the use of railways and manufacturers. The railways will not use artesian waters if they can help it, especially when it comes through limestone. In many towns the revenue from railway companies is a considerable item, which must be considered, and unless we are unable to adopt some other method of supplying water it is very doubtful whether it is always desirable to use artesian water.

The President—I do not always deem it advisable to look for artesian water, only in the event of there being no water supply close at hand. Before going any distance to reach a surface water supply it would pay to make investigations as to the underground waters. Of course, the data might already be at hand through private individuals having sunk wells ; and if they have got water so impregnated with mineral that it would not be suitable for water supply, of course there is no further investigation needed.

Mr. Van Buskirk—I do not refer to water impregnated with mineral matters. I refer simply to the hardness of water. The whole denunciation is on account of that; and, although our public may not be very much averse at the outset to a hard water, its objections will soon be made; it has come to that in every other part of the globe, and machinery must be put in for softening the water. Where it is at all possible to get soft water it would be the best thing to get it. I prefer the soft water in all cases; that is my own personal opinion, and I think in future the public will demand it. The business of the artesian water supply is new, and is very attractive, no doubt about that. You can dig a hole at your pumping station and get the water ; in many cases it is the only thing to do, but in future I am satisfied the public will demand something better, and there is no doubt that the bacterial system of filtering water with sand filters will give us a perfectly pure water; and moreover, it is not hard—that is the main point.

The President—Mr. Van Buskirk seems to assume that artesian waters are necessarily hard. Well, of course, they are harder than the rain water, in this province at least. But in Berlin we have secured an artesian water supply which is, on the authority of the Provincial Board of Health extremely low in the scale of hardness. The first requirement of a water supply is to give good drinking water to the people of the town requiring the supply. If they can be given it so soft that it will make good water for boiler purposes, all the better; but it seems to me it is the duty of the manufacturers themselves to soften the water for their own use. We find if you give beautifully clear, pure water for drinking purposes that the townspeople are quite satisfied, and do not care much whether it is going to scale the boilers or not.

We have with us, as a visitor, Dr. Bryce, Secretary of the Provincial Board of Health, and we would be glad to hear from one who has had extensive experience in artesian water supplies.

Dr. Bryce—I thank you, Mr. President, for the opportunity of making a few remarks on this paper. I know of no subject which combines the several arts of the engineer and the Health Officer more than that of the question of artesian wells. It was my fortune years ago to live at the College in Guelph, and I then was responsible for the recommendations which I made as to the sources of water supply for that city, and since that time in my present work I have naturally felt an interest in the subject. I know pretty nearly all the sources of the public water supplies in this province, and the variations in the constituents which are found in the water is one of the most interesting things I know of.

We may divide water into five classes, quite different from the analysis of a standard water which we get in our older chemistry books. We all understand how that is. We have a Laurentian region towards the north giving us a water without a fragment of lime in it. We have got the waters of the upper lakes almost free from lime—I think about one to two degrees of hardness. We come around to Lakes Erie and Ontario, and there is seen a certain amount of lime as we see the water from rivers flowing over the limestone coming into these lakes. The hardness of water of Lake Ontario is about eight in the scale—wholly different from the upper lakes. Then we have our river waters, some of which are really hard, some really soft, as the Ottawa, flowing from the Laurentian region. And then we come to this class of artesian waters. Both you, Mr. President, and Mr. Van Buskirk are right concerning the difference in hardness in these artesian waters. Mr. Bowman is also quite right in speaking about the relative softness of the artesian water of the Berlin supply. Only last week we made an analysis of this water. After using artesian wells for several years in Goderich they gave them up some time ago and went to the lake, with the result that we have had outbreaks of typhoid fever there, because the sewage of the town happens to run into the Maitland river, which empties into the lake not far from the supply, so that they might better have stuck to the hard water. There is another most interesting thing in connection with waters, namely, the amount of other compounds in them; for instance the amount of organic matter. One could hardly conceive that water down 130 or 140 feet below the sand would have a high amount of organic matter; yet the samples from Aylmer analyzed quite as high as the waters from the bay at Parry Sound, giving 3 parts of free ammonia and 0.24 of albumen ammonia in 1,000,000 parts of water. Of course, it is at present in a different combination, there being no notable nitrates present, reduction having taken place. One wonders how it is that so deep a water should have organic matters so high. The only explanation apparently is that it is on the top of those rocks in which are those organic matters which seem to make coal oil. Certainly such water has no sanitary difference, because it is absolutely pure microbic matter, and thus the effect upon health could not be bad. The other element in such water is the chlorine. We have had some experience in this. About ten years ago the Town of Kincardine required water. The great lake was in front of them there. There were also springs where they could gather emerging water on the clay under the sands near the lake shore. I said to them: "If you take lake water, you will have to filter your water or filter your sewage." In the meantime they discovered that they had an artesian well in the town ; and one engineer of an American company went home and reported upon what had been stated by the previous engineer regarding the proposed sources, and informed his people that there was a splendid artesian well to be had. But No. 1 got back at him by having it analyzed, and found that it had 1,000 grains of common salt to the gallon. The whole explanation was that the boring had been for salt through the upper limestone, in which was abundant water, down to where the salt formation was. They had gone for salt, and they got salt water, but the water did not come from where the salt was. The water came from the underlying rock, about 120 feet, and after boring for salt the water dropped into the boring, dissolved out salt, and came up as an artesian well supplying 1,000 grains to the gallon. The result ended in taking the water from a well on the sandy lake shore, into which sub-surface and lake water both filter.

I could go on relating to you the conditions under which many of these artesian waters occurred. I know fifty cases in the Province of Ontario which are most interesting. I know nothing more interesting, from the uncertainty as to what you are going to get as you bore down. Then, 230 grains of salt per gallon occurred in the Chatham well, but the closeness of the clay seemed somewhat to prevent the water from coming with any great force, and the supply proved insufficient. These wells are lower than the lake, and whenever Lake Sinclair got stormy the influence spread rapidly to those deep waters, and they came up milky in appearance, and there would be a foot or two increase in the head of these artesian wells' supply. I presume the influence—that is, the pressure on the water, caused it to flow up a foot or two, and compression of air in the water caused the milky color.

I asked Prof. Galbraith whether my explanation was correct in regard to the Newmarket artesian wells. The borings go down below the level of Lake Simcoe, and the water in the deep water-bearing sand would naturally flow out into Lake Simcoe. However, the artesian well exists there, and they have taken the public water from there; and the professor agrees with the supposition that the sand, plus the lake pressure, prevents the outflow of water in the water of the lake as readily as the head of water causes it to be lifted up a tube or boring rather than to force itself through the sand. The water comes up through a boring, which is down some 130 or 140 feet.

These are but a few illustrations; and certainly I know of nothing that is more interesting to the geologist, the engineer and the health officer than this whole question of artesian waters. Fortunately in this province we have these artesian wells in every corner; even as far north as Huntsville, on top of the Laurentian, they have an artesian water supply. I may say in regard to the question of goitre that a great deal has been said in regard to the lime in water for the last thirty or forty years as a cause of it, but I regret to find that no one has yet discovered anything on the subject. We were told years ago that the goitre of the valleys of the Alps was due to the existence of lime in the water. Now it happens that goitre is prevalent in many of the valleys of the granite rocks where there is no lime. So much for the theory of lime in water. I heard also from one of our doctors, who has a large practice in this special work, that the chief number of his goitre patients come from the Laurentian district, a district where there is no lime. Personally, I think that the goitre has more to do with the habits of life in the matter of diet than anything else; and I would say in answer to Mr. Gibson that I am quite certain that the amount of lime that is in our various foods, such as meat products, is probably ample for all our purposes, and that the amount of water that anyone is going to drink from Muskoka is not going to seriously affect the question. As you know, boiling water takes out much of the lime; and after boiling your house water it is, relatively speaking, soft water anyway. I confess that there is not enough of practical importance in this question of lime as the cause of goitre to interest me very much. Personally, I am convinced we had better stick to the waters than any other source of drink supply.

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SOME PUZZLES IN OUR MINING LAWS (ONT.)

BY A. J. RUSSELL.

Considering their rigid adherence to straight lines over swamps, lakes and crags, with fly and rain accompaniment in summer, and deep snow with 40 deg. F., below zero in winter, and a beautiful combination of the two in spring, surveyors are the hardest worked and most uncomplaining people on earth, and it should not be considered surprising if, after one third of a century of such experience, an occasional crank like myself is developed, especially, when you add to the foregoing, the mental strain of striving at the interpretation of the "elegant" (as a Yankee legal friend of mine calls them) Mining Claims Clauses of the Mines Act.

I desire to warn my poor struggling brethren of the ordeal they will have to undergo in their endeavors to "catch on" to the Q. E. F.; viz.: a correct delineation on the ground, accompanied by the usual plans, etc., for Lease or Patent—a survey which you can conscientiously accept pay for as being "according to law."

The Regulations for Mining Divisions, approved by Order-in-Council of September 15, 1897, would apparently indicate that the Government, for which the Mining Bureau must assume the responsibility, had hatched—so far as Mining Claims were concerned—a series of Clauses which placed unlimited powers in the hands of the Commissioner of Crown Lands, the Bureau fondly imagined they had evolved an improvement in the Dominion and British Columbia Mining Laws, though I am quite certain, the present Director of Surveys would not endorse such impracticable regulations.

On the 29th January 1898 these regulations were "revised and amended," and finally on the 27th May 1899 they were again polished up by an Order-in-Council, and eventually, after nearly two years of experience and tinkering, we have been given superficially clear and concise "Regulations *re* Staking out Locations in the Unsurveyed Territory of Ontario."

The clauses I desire more especially to draw your attention to are Nos. 6, 7, 8, 9, 10, 14, and 16.

How, in the first instance, the great bulk of explorers and prospectors of limited education and means, and eventually the surveyors, are to manage to comply with those regulations is a conundrum. To begin—the surveyor is not given a starting point, and consequently has to toss up for the choice of position, or act on the advice given in an able paper on "Descriptions," read before this Association by our eminent confrere, Mr. Otto Klotz, where he says: "The law certainly does not constitute the surveyor judge in such matters, but law is supposed to be the incarnation of common sense, and he makes his survey and description accordingly."

Taking the clauses *seriatim:*

Clause 6 requires that corners shall be marked by a post or iron bar; and surveyors, of course, would be delighted to have such a precise point as an iron bar to connect with, but such refinements are conspicuous by their absence, and in some cases not even a post is in evidence. Occasionally a large stump does duty for a post, interfering with the placing of a transit at the corner; and again a tree, and sometimes even several trees, all intended to indicate one common point—very mystifying and provocative of *gores* and *augmentations*. What a field of work is thus being provided for an unscrupulous, I was going to say, surveyor (but that would be a libel on *our* profession), or a less scrupulous brother of the legal fraternity.

Clause 7 states that a location staked out "shall be a square" of so many acres; the older regulations read, "not to exceed" so many acres, which was much more rational, as we know that mathematical exactness being impossible, the saving reservation of "more or less" enters into all such measurements. What do you say to an allowance margin in excess of 30 per cent.? Surely such liberality must have been learned in the same old school that produced a surveyor, who laid out a large timber limit and handed in a beautiful pictorial plan, but unfortunately, when his notes were checked therewith, and his attention drawn to what was deemed a glaring discrepancy, he naively remarked: "See here, if you fellows are going to make such a fuss about a mile or so this matter will never be settled."

A prospector with good, long legs should be in demand for pacing the sides of claims, so long as he acts "on the square," for surely that should be adhered to, as it is much easier to approximate to a right angle than with one's legs as a pair of dividers to measure, within a reasonable limit, amongst hills and swamps.

Clause 6 also requires that the boundaries shall be laid out east and west and north and south *astronomically*. but the results on the ground are apt to recall the famous arguments respecting the disputed north-western boundary of the Province of Ontario, when they were endeavoring to elucidate the meaning of "northward" from the forks of the Ohio and Mississippi rivers. It was then contended that northward might mean "in a northward direction, but going easterly or westerly"; any line, in fact, having an inclination, be it ever so slight, northerly from east or west; and I presume, in places where local attraction or oblique mental vision prevails, an equally liberal interpretation might be allowed.

Clause 9 refers to a method of indicating the true position of a corner which falls in a lake. It says such a corner "*may be* indicated by planting at the nearest suitable point a witness-post with certain marks thereon," and thus leaves it optional with the locator to plant a witness post or not as he pleases.

The change of the former appropriate name of "Mining Claims" to "Mining Locations," thereby confusing the term with the nomenclature in Clause 28 of the Mines Act in the last Revised Statutes relating to the actual survey by a surveyor of a mining location (in the sense in which it has always been heretofore understood) is in reality a retrograde step, although apparently giving force to the clauses I have criticized. The result apparently is that "any person," on payment of $10 for a miners' license, can practise surveying (?) in the field, whether a British subject or not, quite regardless of the conditions imposed on the members of our Association.

On a first perusal of the regulations the uninitiated might imagine that the Bureau had evolved a perfect set of rules, and when I quoted them for the first time to my professional brethren the usual remark was, "It appears quite simple. It's a perfect square. You commence at No. 1 post; run south (ast.) fifteen chains; thence west (ast.) fifteen chains; thence north (ast.) fifteen chains to the point of commencement." Such exactness we do, indeed, see carried out in the location and survey of mining claims on Dominion lands or in British Columbia. Where No. 1 post is a governing point, and the direction towards No. 2 post as governing the alignment, which may be in any direction, but our claims have *corners*, which have been *staked* out, and presumably must be perpetuated; in fact, I am officially informed that a surveyor must *join the corner-posts by straight lines*, so that all the "shall be's," and "astronomical," and "fifteen chains," and "square," and "22½ acres," really have no existence except on paper.

Well, gentlemen, not wishing to arouse ill-feeling by arbitrary action, and taking it, of course, for granted that the framers did not know what the outcome might be; hoping also by diplomacy to arrive at a happy solution of some of the puzzles, I wrote, July 28, 1899, asking the Department of Crown Lands how, under certain contingencies, I should proceed to make a survey. The reply was delayed for nearly three months, until 16th October, by which time I had decided to withdraw from that unfortunate division. And a rumor obtains that there were widely divergent opinions amongst those who were consulted in the matter, and who might be held responsible for the consequences as to what form the reply to my letter should take; some one even venturing the opinion that the lines *as blazed* should be followed. This may be law, but I do not think any surveyor would undertake the contract for making such a survey for $100 a mile, even were it at all possible. Here several sketches were shown on the blackboard, exhibiting the errors that come in under the present system.

It is needless to go into details respecting the various surveys that were made, and the multiplicity of combinations developed. The diagrams coupled with the regulations afford, to even an unprofessional critic, ample opportunity for mental gymnastics.

Several rather novel ideas, originating in the Bureau in its attempts to further instruct the explorer when at sea, respecting staking and eventual survey of claims, have come under my notice, but I believe enough has been already exposed to convince this Association that it is time to draw the attention of the Government to the serious consequences which must follow from an adherence to the unfortunately impracticable Acts and Regulations, as they now are and have been for several years past. I have touched on some of the instances which have already caused much trouble and heavy expense, and, if I am rightly informed, the Government is either unable or unwilling to attempt an interpretation of its own Acts.

The British Columbia Regulations, respecting the staking out of claims, result in a heterogeneous-looking collection, when a group of contiguous claims are surveyed, but the discoverer of valuable mineral can, in a very brief time, mark out to the best advantage, and in an indisputable manner, the dimensions of the land he is entitled to. The final precise location of the corners and definite boundary lines is left to the surveyor, the explorer having but three posts and one line to mark, thus avoiding all the entanglements resulting in after years from, as in the present system, having three lines run on each side, viz.; The first, a blazed one, by the explorer; the second, a trial line by the surveyor, and the third, the final line, a blazed one, also by the surveyor.

If the Government are wedded to the present corner and boundary system, it would be well to add an explanatory clause to the effect that reasonable approximation to the alleged ideal was expected, and that the explorer should, for his own sake, as well as in the interests of those who might follow him, run a visible picket line (not blazed) from post to post. This would be a vast improvement on the original non-apparent (blind?) line, and a step in advance of the blazed curves and kinks now to be found. The corners should invariably be large posts, well driven in the ground, and surrounded, where convenient, with a pyramid of stones, which would be in evidence were the post destroyed by fire. The corners should also be tied in to bearing trees, the kind, dimensions, distance and direction being recorded with the local inspector. Where a corner falls in a lake, the witness post should invariably be assumed as being north, south, east or west, as the case may be (ast.), from the actual corner. The prolonging of the land boundary should not be tolerated, as, when that distance is short and the described direction seriously out, an absurd and annoying enlargement of error must follow.

Before closing, I desire, on behalf of the genuine explorer, to press two matters. The first is that when a license is purchased, either from the Crown Lands Department direct or the local inspector, it should be good for its face value as a license in any part of the Province. The next is one deserving of immediate attention. In staking claims, the "one man, one vote" principle is, I trust, the spirit of the law, and the buying of licenses on behalf of "his sisters, his cousins, and his aunts" should be entirely done away with, otherwise the man with many *aliases* can lock up a large block of land, to the manifest discouragement and disadvantage of the really poor explorer, of whom, as, indeed, can be sometimes said of more than one surveyor I could mention, $10 occasionally represents the amount which overlies his proverbial "bottom dollar."

DISCUSSION.

Mr. Van Nostrand—This paper is from Mr. A. L. Russell, of Port Arthur. The paper has just arrived, and I have had no time to read it over, previously, but I hope there will be a discussion.

Mr. Speight—I am sure we would all like to hear from our old friend, Mr. Blue.

Mr. Blue—This is the first opportunity I have had of attending the meetings of this Association. I have been reading your reports for years and I do not remember to have come across a paper in all your published proceedings that has struck me as forcibly as this paper has. I know something of the matters which have been criticized by Mr. Russell, and I am not a little surprised at the number of complaints he has made. Why he should speak so much in detail in the discussion of the matter or why he should fail to comprehend what I conceive to be the clear and transparent meaning of the Mining Act, I do not understand. He tells us that he decided there is no starting point in surveying this kind of claims. Just allow me before referring to that, to refer to his criticism of the use of the term "mining locations" in the Act as distinguished from mining claims ; a mining claim was held under a license, and the tenure was simply one of holding and working. But many of the claim holders said we want something more permanent than that when we come to dispose of our interest to prospectors, the great majority of whom are simply prospecting in order to discover some valuable deposit of mineral which they may place on the market, not which they themselves may work. Well, we regarded that as reasonable and provision was made under which a mining claim might be surveyed and taken up as a mining location under the provision of the Act relating to mining locations.

Mr. Russell says that there is no starting point in the survey. The regulations of the Act itself are quite distinct. The starting point is the post No. 1, which is the north east corner post of the claim, and in the staking out of a claim the regulations under the Act call for the planting of a post of iron or wood to distinguish it. It is not the fault of the Department if a prospector knows the provisions of the Act, and yet marks his point with a stump or stone or any other article. If he does so he is simply not carrying out the provisions of the Act, and if the inspector should go into his locality he can require him to do so. The regulations of the Act fixed four different marks on a claim, Post No. 1, Post No. 2, Post No. 3, Post No. 4. They are required to be at a certain distance from each other and it is assumed that the lines between them are to be run as astronomical lines. We all know pretty well that prospectors are not able to run astronomical lines with the use of their compass, and that country is rough and rocky with a great many inequalities. We have, therefore, not made any provision in the Act to require the exact measurement or exact lines. But if the complaint is made to the inspector that a claimholder has not run his lines astronomically or if the boundary lines are in excess of the lengths described in the Act, and if complaint is made to the Inspector, he has simply to call in the services of a surveyor and to run the lines astronomically, and what I say is that the limits as described in the Act start out from one post. It is, therefore, quite incorrect on the part of Mr. Russell, if I understand him aright, to say that there is no starting point in the survey of a location.

I have already referred to his complaint in regard to the excessive area. There is no doubt, I think, in the case of some of the claims there has been an excess of area as staked out; but the Act remedies that matter. It is only necessary to make complaint to the inspector and a correction is made.

I understood him to say again that we had introduced a provision into the Act which gives to a licensee the authority of a land surveyor. There is no provision of that sort in the Act or the regulations. The licensee who takes out the license, for which he pays $10, has the privilege of staking out his claim; but that does not constitute him a licensed surveyor, and his lines would not be recognized as the lines of a licensed surveyor.

The special case that Mr. Russell has used for his illustration involves some difficulties ; but in my judgment they are difficulties which to a large extent have been created by Mr. Russell himself. Mr. Russell appears to think that the Government have had some difficulty in understanding the Act and the regulations themselves. I know that this is not the case. A memorandum was submitted to the Government. It was considered by the Attorney-General's Department, and it was agreed to; and these surveys will be carried out in accordance with the interpretation put upon it by the department, which, I think, is a clear and common-sense interpretation. I do not see myself where the great difficulties come in that trouble Mr. Russell; perhaps they would be obvious to you who are practical surveyors. I should be glad to hear what you have to say on the subject.

Mr. Kirkpatrick—Well, I have not very much to say, because I have not entered into this question before. But Mr. Blue says that it is now before the Department. You will notice that in the Rules and Regulations it is provided that the parties shall blaze out the lines. Well, I have heard from different surveyors how this is done: that they do not pretend to range a line at all, but that they look ahead, and they walk around, and they blaze a tree here and there; and in one case, when a man got to the corner, he rolled down an embankment about 100 feet, and he put his mark there because he did not want to climb up again! The consequence was the blazing was here and the post there. I would suggest that the line be picketed, and not blazed. The man after taking his compass and getting his course, should put in a picket; it is not a very great distance to run in any case, and if he just cut out some of the brush that was in the way and picketed these lines so that anybody could see them, they would remain visible for a year or two, or perhaps longer, until he could get his claim surveyed.

Mr. Blue—At what distance are the pickets?

Mr. Kirkpatrick—Oh, the distances vary. If they are going to run over a hill, they have either to use very long pickets to get over, or they have to use a large number of pickets. Running on a level, I think that five chains is about what surveyors have between pickets. The lines should be picketed out and the posts planted.

I do not exactly understand Mr. Blue's remarks about turning a mining claim into a location. As I understand it, they call them mining claims always.

Mr. Blue—They are not mining claims; they are called mining locations.

Mr. Kirkpatrick—I do not understand that.

Mr. Blue—My understanding is that when surveyed they are mining locations.

Mr. Kirkpatrick—I do not think that that amounts to a row of beans.

Mr. Blue—This has been the custom for years.

Mr. Kirkpatrick—A mining location is defined in the Mines Act as being an area of 40 to 320 acres.

Mr. Blue—A mining claim is there defined also.

Mr. Kirkpatrick—Not in that clause. That is where I think Mr. Russell's difficulty has arisen. If the Mining Act had specified that a mining claim on being surveyed should be declared to be a mining location, it would be a mining location; there is no gainsaying that. There is nothing else I can say on this matter. I am not prepared to criticize what Mr. Russell has said.

Mr. Speight—I can quite understand the difficulty that the prospector would have in blazing out a line and coming within the limits of the Act as far as the distance specified is concerned. It is an exceedingly rough country; many of the hills there are very high. I happened to meet Mr. Russell up in that country. I was running some lines for the Government, and he was then surveying there.

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AZIMUTH AND TIME BY OBSERVATION ON POLARIS.

By CYRUS CARROLL.

The paper by Mr. Stewart published in the Proceedings for 1899 is certainly a very useful one, as it gives formulae for reduction of observations.

I, for one, shall not attempt to follow out the brain twisting calculus by which he obtained such admirable results,—life is too short, and besides, I don't know whether I could do it or not. I am content to take his formulae for granted—the same as I do our tables of Logarithms and in fact all our Mathematical tables, though not entirely ignorant of the means by which they were made.

I am speaking, of course, for myself only, but I think most surveyors have openly or secretly the same mind about these things, I have said that it is most useful, but that depends. For topographical or for astronomical work in an observatory, with all required assistance, with instruments in perfect order (probably not much used), it is necessary to be so exact that the error will be too small a quantity, to be assignable, will in fact be exhausted.

But for timber limits, mining locations, subdivision of Townships, subdivisions of sections or lots, an approximation as near as 20″ to the true direction is as near as it is of any use to make it, being only six inches in a mile, which unless the line be run with two picketmen, back targets, setting two or three points forward, at a quarter mile apart, testing to see if all is in line, and then on moving forward, test the last few points backwards, aligning on the target, using tacks and shingle nails as points,—I say unless the line be so run the deviations from a

Now $OP = \sqrt{SP^2 - SO^2} = \sqrt{4417^2 - 1596^2} = 4118$

$$AZ = \frac{\text{Rad.} \times OP}{\text{Cos. Lat.}} = \frac{\text{Rad.} \times 4118}{\text{Cos. } 43^\circ\ 39'\ 36''}.$$

Log. Rad. = 10.000000
" 4118 = 3.614686

13.614686
Log. Cos. 43° 39′ 36″ = 9.859408

Log. AZ = 3.755278

$\therefore\ AZ = 5692'' = 1^\circ\ 34'\ 52''$

$$\text{Nat. sin } WPS = \frac{OS}{SP} = \frac{1596}{4417} = 0.36126, \therefore \text{ Arc } WS = 21^\circ\ 10'\ 40''$$

21° 10′ 40″, in Sid. time = 1h. 24′ 42″; in Solar time = 1h. 24′ 39″
Add. Solar time at W = 18h. 52′ 42″

Time of Observation = 20h. 17′ 21″

Comparing Azimuth – Mine = 1° 34′ 52″
Mr. Stewart's = 1° 34′ 47″

Difference only 0° 0′ 5″

Place of Observation west of Standard, in Sid. time = 0h. 17′ 35″
in Solar time = 0h. 17′ 34″
Add my time as found = 20h. 17′ 21″

Standard time = 20h. 34′ 55″

Hence it appears, that if I had used his watch, I would have arrived at the same result practically, as the 12″ error in the watch would have made no material error in the azimuth.

I find that if I take the observation at 2h. 45′ after elongation and make an error of 1′ in altitude, it will vitiate the azimuth 1′ 15″ and 2 minutes in time. Hence an error of 1′ in time would make an error of a little over 30″ in azimuth at that point.

An error of 1′ in time or in altitude will have but very little effect at 1h. from elongation and not too much at 2 to 2½ hours.

This leaves an interval of 5 hours in which this sort of observation may be approximately made. I have never yet had to wait long. It pays to have a good reliable watch, well regulated, and to make a note of its rate, and a quadrant or sextant, a big one (not the little round pocket toys) with which to take altitudes properly.

with hours numbered from midnight to midnight and calculated for 4h. 46′ W.

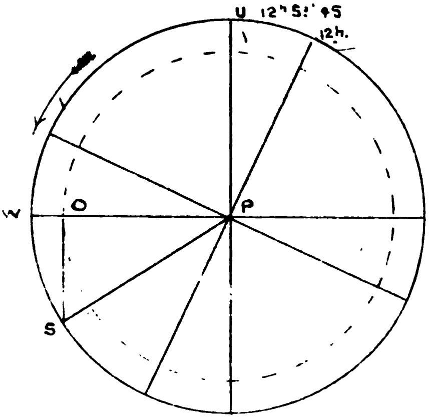


FIG I

For the purposes of explanation, I refer to figure 1 which is the circle of apparition. The upper transit of the star at U = 12h. 53′ 45″ (per Canadian Almanac).

W its west elongation, S is the star, P the pole, SO a perpendicular let fall from S on WP meeting it at O.

SO = Latitude — Altitude.

SP = Polar Dist. (per Almanac).

For the purposes of azimuth the triangle S.P.O. may be treated as a plane triangle, with its sides expressed in seconds as units of linear measurement.

With the given parts SP and SO, I find the angle SPW, the measure of the arc WS which is the time after the elongation.

And with the same SP and SO, I find OP which I treat as if it were the Polar distance and as if the dotted circle were the path of apparition. I use his longitude for the 4″ correction in the time of the upper transit and to bring my time to the standard time that Mr. Stewart uses.

Here is the preparatory arrangement of the data.

Time of upper transit (Can. Almanac)				12h	53′	45″
Correction for 4h 46′ to 5h 17′ 35″						4″
Solar time of upper transit				12h	53′	41″
Arc U.W. = in sid. time 6h 00′ 00″						
In Solar time				5	59′	1″
Solar time of West elongation				18h	52′	42″
The Latitude	=	43° 39′ 36″				
— Altitude	=	- 43° 13′ 00″				
OP	=	26′ 36″	=		1596″	
Polar Dist. per Almanac = *SP*	=	1° 13′ 37″	=		4417″	

straight line will be more than 20″ or 30″ of azimuth would cover.

Students fresh from college, who "know it all," will ridicule this, but old surveyors like myself will know it is true. The one year's apprenticeship is not sufficient to enable any one to understand and handle a transit with all the nicety required, more especially if his practice is in the usual way of setting the instrument up over a hole in the ground, and sighting to a big unshapely picket, shaking in the wind and its upper end not always staying where it was put by sighting from the instrument. Then again, he may not go out once in a week.

An instrument 1,000 miles from the maker, in constant use, not to say abuse, for months, in a range of 150° of temperature, will inevitably get somewhat shaky, and in such condition must be used.

I use the tangent screw only in turning off the azimuth. This is good in any case, but especially so with shaky tripod.

I always use "Polaris" when I can. In fact, it has always been *The Sun* or Polaris with me.

It is quoted of Delambre, that he had much experience, and that he deprecated the use of two stars, claiming that he had better results from one.

I prefer to take the observation in twilight, when I can just see the star and the wires, without any artificial illumination.

I place the transit in good daylight, plates at zero and clamped, select my reference object, if possible so near the line of the star that in moving from it to the star I need only to use the upper tangent screw. Then I elevate the telescope to the latitude which brings the star in the field, then clamp the vertical circle, and with one hand on its tangent screw, and the other on the plate tangent screw, I bring the intersection of the wires on the star, and note the time. Then I drop an oiled silk cap lightly over the instrument, so as not to distend it, and leave it till morning, but as a precaution against possible movement of the instrument I take the readings.

I now take up Prof. Stewart's observation, using his data but adding the observation for altitude which must be had for my purpose when I don't use the time. I don't make use of the time because he did not. I use the Canadian Almanac

The latitude is a vital requisite as well as the altitude. The latitude is generally to be got at within convenient limits, by dead reckoning, *i.e.*, by course and distance from some point where it is known, or the sun can be used to get it, or by any star of which we have the declination.

If we are nearly in time for the transit of "Polaris" across the meridian, we may use that, if not, then we shall be near the elongation probably, and if we use elongation, the latitude need not be got so exactly.

In the first hour before and after elongation, if we have the time within 5 minutes, it will be sufficient.

The writer is aware that this solution of Mr. Stewart's example, is not absolutely and mathematically correct, but it is nearly so for azimuth—not 6 seconds out, which is near enough for 96 per cent. of the work of 90 per cent. of the *profession*, that is if used within, say, 2½ hrs. of elongation. I would not use it in getting the time, as there are easier and more accurate ways of doing that.

As I cannot be present, I would ask that kind consideration be given to that fact. I would not be understood as undervaluing Mr. Stewart's formulae. I am glad to have them and shall use them when on the finest kind of work, but I think for practice such as most surveyors have, my method is preferable as being shorter and more simple.

Its very simplicity will be a fatal objection to it, with some surveyors, but it ought not to be.

DISCUSSION.

Mr. Ross—This interesting paper by Mr. Carroll is before you, and I think we would like to have some remarks from Mr. L. B. Stewart.

Mr. L. B. Stewart—On looking over Mr. Carroll's method, at first I was a little inclined to regard it as a rough one, but I saw there was a possibility of arriving at a method of finding the azimuth from the data he used, so I have kept a few of the results I worked out some days ago. By his method he works out an example, and gets the same result as I do within five seconds. I took the same example, and worked out the altitude of the star at the time of observation, and figured out the azimuth from that, using an extension of his formula, and I found its value to be equal to 5707″.3 minus 20″.7, the difference being 5686.6. This result agrees with the azimuth obtained in my example last year within a few tenths of a second; in fact, I call it 5687, so there is a practical agreement. Mr. Carroll gets the same result within five seconds. But the value of the altitude he uses is 43 degrees 13 minutes, and the value of the altitude which I worked out from the example contained also 27 seconds, and I think that is where the difference comes in. I consider the method a very good one if used in this form; using the simpler form of the equation, it might be in error to the extent of twenty-one seconds. Of course, for a great many purposes that would not be very important. It is evident on the face of it that the method cannot be used when the star is very far from elongation. If the star is near the meridian a small error in the altitude will have a very considerable effect on the resulting azimuth.

Mr. Ross—I think we are doubly indebted to Mr. L. B. Stewart for the explanation he has given and the formulae he has worked out.

Mr. Niven—I think we are very much indebted to Mr. Carroll for writing the paper, and to Mr. L. B. Stewart for the explanation he has given us. Of course, it would be a very nice thing to have this worked out so that people could get an observation at any time. But up to the present time I must say that I have confined myself to elongation, preferring to put up with a little inconvenience and do something I am certain about rather than risk the other.

I move that the paper be received and printed. I would also move a vote of thanks to Mr. L. B. Stewart.

Mr. Speight—I have great pleasure in seconding that. I am glad to see that there is so much in the paper to commend itself. Apparently Mr. L. B. Stewart has checked the formula that is given by Mr. Carroll with great care, and we must all say with satisfactory results.

Mr. L. B. Stewart—Mr. Chairman, I think this method of Mr. Carroll's is a very useful one, as it gives the surveyor much greater latitude in which to work, a much greater length of time during which he can observe for azimuth; and, I think, even one hour after elongation, that by his method azimuth can be determined, and should not be more than half a minute astray.

[*This Association is not responsible as a body for the opinions expressed in its Papers by Authors.*]

AZIMUTH BY POLARIS.

By OTTO J. KLOTZ,

Ottawa.

The accuracy of the direction of lines of survey is becoming more and more important with the development and progress of our country. As many of our surveyors are engaged in laying out new lands, establishing the astronomic courses of old compass lines, laying out mining claims and other work requiring the determination of the true meridian, it is thought that a few words on the azimuth observations on Polaris might be opportune.

I think that, generally, an observation for azimuth is looked upon by surveyors as more or less of an undertaking. This should not be the case. Theoretically, the best time for taking an observation on Polaris is at elongation, for the element, time, has then its least effect. However, as the time of elongation (eastern) comes only at a convenient time from the middle of August onward to the latter part of October, i.e., the time varies from 10 p.m. to 5 p.m., the earlier summer months necessitate sitting up or getting up at night at inconvenient hours, for making observations, besides running the chances of a cloudy sky. If, on the other hand, the surveyor adopts the method of observing at any hour-angle, which too is a simple operation, he will be able to choose his own time and convenience, with satisfactory results.

In connection with observations at elongation, it may not be amiss to examine the effect in azimuth of small changes in latitude and declination in the data used.

In the spherical right-angled triangle we have

$$\text{Sin } A = \text{Cos } \delta \text{ sec } \phi$$

where A = azimuth, δ = declination, and ϕ = latitude.

Differentiating we get

$$\text{Cos } A \, d A = \text{Cos } \delta \text{ Sec}^2 \phi \text{ Sin } \phi \, d \phi \qquad (\delta \text{ considered constant})$$

$$\text{or } d A = \tan A \tan \phi \, d \phi$$

by which we can find the change of azimuth for small changes in latitude.

Taking for Polaris $\delta = 88^\circ\ 46'\ 26''.72$ (mean place for 1900) and $d\phi$ the small change in latitude as 1′ or 60″, the corresponding change in azimuth dA is shown for various latitudes (covering the field work in Canada) in the following table:

LATITUDE	AZIMUTH	DA	LATITUDE	AZIMUTH	DA
42°	1°38′59″.02	1″.56	54°	2°05′09″.41	3″.01
43°	1°40′34″.80	1″.64	55°	2°08′15″.52	3″.20
44°	1°42′15″.62	1″.72	56°	2°11′33″.55	3″.41
45°	1°44′01″.80	1″.82	57°	2°15′04″.59	3″.63
46°	1°45′53″.68	1″.91	58°	2°18′49″.84	3″.88
47°	1°47′51″.67	2″.02	59°	2°22′50″.66	4″.15
48°	1°49′56″.16	2″.13	60°	2°27′08″.58	4″.45
49°	1°52′07″.64	2″.25	61°	2°31′45″.38	4″.78
50°	1°54′26″.59	2″.38	62°	2°36′43″.06	5″.15
51°	1°56′53″.59	2″.52	63°	2°42′03″.95	5″.56
52°	1°59′29″.25	2″.67	64°	2°47′50″.68	6″.01
53°	2°02′14″.27	2″.83	65°	2°54′06″.38	6″.52

The effect in azimuth increases rapidly with the higher latitudes as is evident, too, from the above formula Sin A=Cos. δ Sec ϕ The figures given in the last column correspond to those given in the Canadian Almanac as "Second correction."

It may be well to explain that all azimuth tables of Polaris for elongation, even when expressed to individual seconds, are in a measure inaccurate, inasmuch as a constant declination is used for the year, which of course, is not correct. The difference in the mean and apparent declinations is sufficiently large —about three quarters of a minute—to cause a difference in azimuth of over a minute. Hence, one must not imagine to obtain correct azimuths from such tables to within a few seconds without considering the proper conditions. Any such tables are undoubtedly correct for the assumed data, but we must make sure that those data obtain for the time and place of observation.

Observations, otherwise careful, have come under my notice, where this consideration was neglected, and results were given to fractional parts of a second in azimuth, when, in reality, the azimuth accurately deduced, shows an error of a "handful of seconds," so to speak.

Taking our formula Sin A = Cos δ Sec. ϕ, and again differentiating with respect to A and δ, for finding the relation between small changes in azimuth resulting from small changes in declination, we have

$$\text{Cos } A \, dA = -\text{ Sin } \delta \, d\delta \text{ Sec. } \phi.$$

As $\text{Sin } t = \text{Cos } A \text{ Cosec. } \delta$

t being the hour angle at elongation

hence $dA = -\text{ Sec. } \phi \text{ Cosec. } t \, d\delta$.

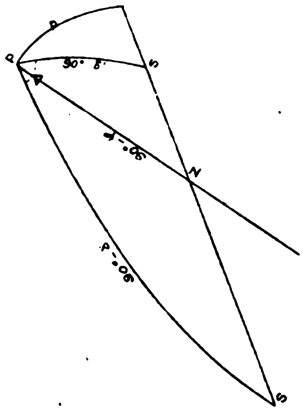
By the negative sign we see the azimuth decreases as the declination increases, or, which is the same thing, the azimuth changes with the same sign as the polar distance. As t is within the wide range of latitude in the accompanying tables nearly 90°, that is Cosec t=1 (approx), hence we may write $dA = -$ Sec $\phi \; d\delta$. t is equal to the complement of the azimuth plus the spherical excess, which is small. Since Sec. ϕ is always greater than unity, the change in azimuth is always greater than the corresponding small change in declination and increases rapidly for high latitutes.

From the general formula it is seen that the azimuth is always greater than the polar distance, except at the equator, where the two are equal. In the higher latitudes the azimuth increases rapidly until the limit of 90° is reached in latitude 90° $-\delta$ where Polaris is at elongation (eastern and western) at upper transit, and the hour angle is zero.

The following table shows the change of azimuth due to 1″ change in declination, using same data as in previous table.

LATITUDE.	*d* A	LATITUDE.	*d* A
42°	1″.35	54°	1″.70
43°	1″.37	55°	1″.74
44°	1″.39	56°	1″.79
45°	1″.41	57°	1″.84
46°	1″.44	58°	1″.89
47°	1″.47	59°	1″.94
48°	1″.49	60°	2″.00
49°	1″.52	61°	2″.06
50°	1″.56	62°	2″.13
51°	1″.59	63°	2″.20
52°	1″.62	64°	2″.28
53°	1″.66	65°	2″.37

We will now consider the observation of Polaris at any hour angle, together with a time star in the same vertical, noting the times of transit of the two stars.



In devising methods and formulae we must never lose sight of the end aimed at, or rather the accuracy desired. For instance, it would be misapplied energy to obtain a latitude to within a second of arc on an exploratory survey, and hence the method of the former would not be desirable for the latter. Use a foot rule for measuring a board and a micrometer apparatus for a base line. With a minute-reading instrument don't give and don't expect results correct to seconds. Mathematical formulae and tables can't produce a closer result than the observation itself. Let there be no delusion with illusory small quantities and decimals. As Professor A. W. Wright in his admirable work "Adjustment of Observations" says: "In a word, we cannot measure what we cannot see." This is in contrast with the illusory statement of Professor Merriman in his recent work "Elements of Precise Surveying and Geodesy": "A good transit, having two verniers reading to half minutes, can easily measure horizontal angles with a probable error of one second if proper precautions be taken to eliminate systematic and accidental errors."

Surveyors, as others, want to travel along the line of least resistance, whether through brule and swamp, or in taking observations and computing them. The more formulae for the field confine themselves to the elementary and fundamental ones, the more they will be used, and for obvious reasons.

Referring to the figure: *P* represents the pole, *S'* and *S* Polaris and time star respectively, and *Z* the zenith.

Between Polaris and a time star (as between any other two stars) at any instant, there is a constant angle equal to the difference of their right ascension. Were it possible to make an instantaneous observation of both Polaris and the time star, then in the figure the angle *SPS'* would be equal to $a—a'$, where a, a' are the right ascensions. However, as an interval elapses between observing the two stars on the same vertical, the constant angle is diminished by this interval, expressed in sidereal time, that is

$$(a—a') — (\tau—\tau') = \Delta = S\,P\,S'$$

where τ and τ' are the observed times of transit over the vertical. Now in the triangle *SPS'* we have *PS*, *PS'* the polar distance of the two stars, *i.e.*, the complement of the respective declinations, $90° - \delta$, $90° = \delta'$ and the included angle Δ. Hence, by Napier's analogies, and the logarithmic tables we readily find the parallactic angle. *S*

Then, in the triangle *SPZ* we have *PZ* the complement of the latitude $=90°—\phi$, *PS* and the angle *S*, hence, by the simple sine formula, the angle *PZS* is obtained, which is the supplement of the desired azimuth of Polaris, or$= \pi—A$.

This method, which does away with the use of the hour angle of the time star, is rigorous, simple, expeditious and accurate, provided the logarithmic functions are accurately obtained or taken out. It may be stated that if logarithmic tables of the trigonometric functions comparable with the vernier reading of the instrument, be used, the result obtained will be in keeping with the attainments of the instrument.

The Napier's analogies required, and expressed in the notations of the above figures are

$$\tan \tfrac{1}{2}(S' + S) = \frac{\operatorname{Cos} \tfrac{1}{2}(\delta' - \delta)}{\operatorname{Sin} \tfrac{1}{2}(\delta' + \delta)} \operatorname{Cot} \tfrac{1}{2}\Delta$$

$$\tan \tfrac{1}{2}(S' - S) = \frac{\operatorname{Sin} \tfrac{1}{2}(\delta' - \delta)}{\operatorname{Cos} \tfrac{1}{2}(\delta' + \delta)} \operatorname{Cos} \tfrac{1}{2}\Delta$$

and the sine formula $\operatorname{Sin} A' = \operatorname{Sin} S \operatorname{Cos} \delta \operatorname{Sec.} \phi$

In the Manual of Dominion Lands another method is given. It depends on the value of the arc, p, from the pole perpendicular to the vertical on which the two stars were observed.

The two formulae there given, are

$$A = p \text{ Sec. } \phi \qquad (1)$$

$$\text{and } A = \frac{\tan P \text{ Sec. } \phi \text{ Sin } t}{1 - \tan P \tan \phi \text{ Cos } t} \qquad (2)$$

in which P is the polar distance of Polaris, and t its hour angle at time of observation.

In the Manual (table xv) the values of p have been tabulated for $\delta' = 88° \; 41'$ and for 10 minute intervals of Δ, and 5° intervals of declinations of time star. For any other value of δ' p must be multiplied by tan. 88° 41′ into tan. of the polar distance of Polaris, given in the Ephemeris.

The table has been computed from the formula

$$p = P \text{ Sin } \Delta + \frac{P^2}{2} \text{Sin } 2\,\Delta \tan \delta$$

Now if we substitute this value of p in (1) we have

$$A = P \text{ Sin } \Delta \text{ Sec } \phi + P^2 \text{ Sin } \Delta \text{ Cos } \Delta \tan \delta \text{ Sec } \phi \text{ Sin } 1''$$

identical with the equation deduced by Mr. Stewart and applied for reducing his observation given in last year's proceedings.

Equation(2) necessitates the determination of the hour angle of Polaris, before the azimuth can be found. This is a wholly unnecessary procedure, for the quantity sought is azimuth and not time.

We therefore revert to our simple, rigorous formula for obtaining the azimuth by observing Polaris on the same vertical with a rapidly moving, or time, star.

To avoid errors of time of transits, the line of collimation should be well adjusted and the horizontality of the axis assured. The mean azimuth of a line determined from two observations on Polaris, one circle east, the other circle west, will be practically free from the collimation error but not of level corrections if axis is not horizontal. In a well-adjusted surveyor's instrument, the residual error of the latter is a negligible quantity.

As α, α', Δ are expressed in sidereal time, so must $\tau - \tau'$ be. The time of observation is always so selected that the interval $\tau - \tau'$ is, say about five minutes. Hence when an ordinary watch—mean time—is used the correction will be only about a second *i.e.*, at the rate of 10 seconds an hour. The correction has to be added to the interval.

Surveyors observing by this method for the first time will undoubtedly meet with some difficulty, *e.g.*, setting for Polaris, to have it in the field, estimating the time they have to wait until the time star transits over the vertical of Polaris after having set the telescope at the altitude (meridian $=\phi-\delta$). However, one or two observations added to gumption will overcome all this, and observing will become a pleasure instead of a dread which it now so commonly is.

The other formula

$$A = p \text{ Sec } \phi = P \text{ Sin } \Delta \text{ Sec } \phi + P^2 \text{ Sin } \Delta \text{ Cos } \Delta \tan \delta \text{ Sec } \phi \text{ Sin } 1''$$

in which P is expressed in seconds of arc, requires a few less logarithms to turn up and is in so far preferable. Although of an approximate form, being the first two terms of a series, it is yet more accurate than results can be looked for from the vernier reading of any surveyor's instrument, and hence furnishes a method to which surveyors can apply with advantage. In working out the above formula it is not as formidable as it appears, for the quantities in the first term are repeated in the second, and hence need not again be taken out.

The main object of this paper is to assist surveyors in overcoming the prejudice or aversion they have to observing Polaris at any other time than elongation. The adoption of observing Polaris at any hour angle, together with a time-star in the same vertical, will add much to their personal comfort and to the greater accuracy of their work, from the fact that more observations will be taken.

DISCUSSION.

Mr. Niven—I do not know that I have much to say. No doubt it is a very good paper. From what Mr. L. B. Stewart, Mr. Klotz and Mr. Carroll have written we ought to be able to make our observations. As I said last night, I have hitherto confined myself to elongation, but it would be a very great benefit, in the way of comfort, to be able to take the observation shortly after sundown. In this paper Mr. Klotz brings everything down to fine points—seconds. Well, that is all right, but it would be very important also that the surveyor should do his practical work with as much accuracy as Mr. Klotz calculates his azimuth. Many of our profession, I am afraid, do not observe as much accuracy in carrying out their work as they should. For instance, Mr. Carroll said in his paper: "A man sets up an instrument plumb over a hole in the ground, and there is no certainty as to whether that hole in the ground is directly under the instrument. There is a great deal in carrying out the observation on the ground, and very much depends upon that; and we should be prepared to give more attention to this matter than we are in the habit of doing.

Mr. Speight—I have no doubt that when this paper is in print we will be able to take it in better, and apply it in our practice. As Mr. Niven has said, there is no doubt by exercising great care in the work on the ground frequent observations are probably not so necessary.

Mr. P. S. Gibson—How often do you make your observations in a township?

Mr. Speight—I take them two or three times a week if the conditions are favorable. I have always one instrument in camp. I have taken observations probably three or four times a week. I have gone two weeks without an observation.

Mr. L. B. Stewart—Mr. Chairman, after all the papers that have been read on the subject of azimuth, it seems to me that the surveyor who waits up until two o'clock in the morning in order to observe azimuth at elongation almost deserves to have it cloud over at a quarter to two.

In looking over the different methods that have been discussed, it seems to me that the best method is by observing two stars, observing some star on the vertical circle of polaris. In discussing the effect of errors of observation, it seems to me that those errors have less effect on the azimuth in that method than in any other, with the exception, possibly, of the observation of polaris at elongation. As I pointed out last night, the effect of an error in either the latitude or in the observed time in the method of observing two stars is divided by about forty; that is. the error in azimuth is about a fortieth the error in either latitude or the time observed; and I think that is all you can say for any other method that I know of. In observing the altitude of polaris for azimuth, say at elongation, the effect of an error in latitude is practically zero; and also the effect of an error in altitude is also about zero; but if the star is far from elongation, the error in either of the data may be multiplied by a very large number. The ratio of forty, which the error in data bears to the error in azimuth, is about the maximum value of that quantity; it may be very much less.

The observation of two stars also is an extremely easy one. The method I follow in taking the observation is to choose some star that transits, say, about dusk, or shortly after sundown. It is then light enough to see a picket on the line whose azimuth you wish to determine, or to set a picket; and when I want to find the pole star I generally find the meridian approximately by means of a compass, and then raise the telescope to an altitude equal to the known latitude, and then find the pole star. A few minutes before the time of transit I set on polaris, and turning over the telescope observe the transit of the time star, which should be one of small declination, and when it crosses the field of view I note the time by my watch when it appears on the intersection of the cross wires. Then the difference of those two times with the difference of right ascension gives the quantity delta that Mr. Klotz uses in his paper. In order to pick out a star that is a time-star that will serve for observation, its approximate right ascension can be found in this way: The right ascension of the sun increases about two hours a month and about four minutes a day; so that knowing the number of months and days that have elapsed since March 21st, you can easily compute approximately the sun's right ascension. If you wish to observe at eight o'clock in the evening, a star suitable for observation is chosen from the almanac whose right ascension is nearly equal to eight hours plus the sun's approximate right ascension.

I am more in favor of a formula in the shape of a series. The series given by Mr. Klotz is identical with the one given by me last year, and two terms of that series are sufficient for all purposes; and the computation of the azimuth from that, I am sure, is a very simple matter.

Mr Van Buskirk—I would like to know if any gentleman has practised taking the observation of the sun in the day time. It is done in the States and in British Columbia on mining claims.

Mr. L. B. Stewart—I used that method myself in practice when I was up north; but the observation is a little more difficult probably than with a star. The instrument that I took out had an arrangement of colored shades in the shape of a little wheel that screwed on in front of the eye-piece; so that a shade of any desired degree of density could be used. Well, unfortunately this affair projected out so far that the telescope would not transit, and it was almost impossible to get an observation, because it meant unscrewing the shades, and that would generally shake the instrument too much for accurate work. So I used to observe stars in the same way as the sun. In the latitude of 64° or 65° the pole star is almost too high for observation. The method I used was: I carried with me, copied from the almanac, the apparent places of about six or eight stars. I picked them out in such a way that I always had a star for observation at any time during the summer about dusk, and I would have also one or two other stars that would serve for latitude observations. Most of the time I found the star Arcturus to serve very well for azimuth, and the star Altair to get my latitude. In reducing, the method is precisely the same as in the case of the sun.

The President—I would like to ask Mr. L. B. Stewart whether the solar compass is still in use by surveyors.

Mr. L. B. Stewart—I have not seen it used much. There are a few, I believe, who use it; but personally I have not a very high opinion of the solar compass. I would far sooner depend upon an observation for azimuth than use a solar compass. One of our transits has a solar attachment, and I find the azimuth with it on a line whose azimuth I have already determined, just in order to form an idea of the accuracy of the instrument, and sometimes it gives very fair results, and at other times it is as much as ten or fifteen minutes astray. Prof. J. B. Johnson, in his work on "Surveying," discusses the solar compass, and he shows that very large errors may result if observations be taken at any but favorable times. The sun should not be too far from the prime vertical. Prof. Baker, in his work on "Engineering Instruments," says that it is an instrument that reflects more credit on the inventor than on the modern user.

Mr. Ross—Although it is probably true that a great many of our members do not find it necessary to take azimuth observations very often, I think the time is coming, and probably very soon, when all registered plans and descriptions will have to show the true astronomical course, and these papers will enable each of us to fix on some method that we may practise and familiarize ourselves with, and which will be of great value to us in the future.

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CEMENT CONCRETE CULVERTS.

By A. W. CAMPBELL.

The subject which, in response to the invitation of the council, I have chosen to place before you to-day, is very much akin to that of last year. This was not overlooked in making my selection. The matter is one which deserves very full treatment for various reasons; and is a detail of road construction regarding which, more than any other, perhaps, I receive inquiry from members of our profession. While there is no dearth of literature and data with regard to culverts of stone and brick masonry, that available respecting cement-concrete arches is very meagre.

The material can hardly be called a new one, for there are viaducts and pavements still in existence which were built by the Romans 2,000 years ago. Its manufacture, however, had, until about thirty years ago, been numbered among the lost arts. It is of a still more recent period that it has been commonly employed, particularly in Canada.

There is a very general impression among councillors with whom you have to deal that it is too expensive. Councils nevertheless, are outgrowing that idea, and in one part of the Province and another, I find waterways of six to eight feet span built of stone, brick and concrete, at a cost of from $500 to $1,000. The old wooden structures, which they replaced, may have cost in the first instance only $50, but they were perishable, constantly in need of repairs, an impediment to travel, at times dangerous, and the trend of feeling is towards more permanent and serviceable work.

The limit of span in which concrete can be used is probably quite equal to that of stone arches. This will remain, for the most part, a question of economy in highway work, and its use will cease where the steel bridge with concrete abutments steps in. The line is not definitely drawn for all cases, but up to forty feet, the least expensive kind of cement-concrete can be used in arches, and certainly up to that point its use is quite feasible. For the longer spans, arches of the Milan type are being used in the United States and Europe—that is, concrete re-enforced with a skeleton of steel.

Arches of concrete may be designed by the formulae used in proportioning arches of stone masonry. But the determination of the line of resistance, and theory of the arch, as applied to stone, cannot be applied to concrete arches. The stone arch is designed on the principle that it will remain in place without the use of mortar; while the concrete arch, on the other hand, is a monolith, dependent upon its cohesive strength.

That the arch is dependent upon cohesive strength, points, it appears to me, to the necessity of a generous proportion of cement, very great care in mixing the concrete, and the best quality of all materials employed.

My meaning with regard to the proportion of cement can be better understood by glancing over the composition of concrete. A concrete can best be regarded as a mixture of mortar and broken stone, the mortar being formed from a mixture of sand and cement. Given a sample of broken stone in a vessel, the requisite quantity of mortar can be gauged by pouring water into the vessel until the stone is submerged. The quantity of water used will indicate the amount of mortar required to completely fill the voids in the stone. The proportionate amount of cement needed to fill the voids in the sand, can be gauged in the same way. The proportions of cement, sand and broken stone obtained in this manner would provide, with perfect mixing, a mortar of which the voids in the sand are filled with cement, and each particle of sand coated with cement; it would provide a concrete in which the interstices of the stone are filled with this mortar, and each stone coated with mortar. This would be the case with perfect mixing, and would provide a theoretically perfect concrete. Perfect mixing is not possible, however, and it is necessary to provide an amount of cement in excess of the voids in the sand, and an amount of mortar in excess of the voids in the stone.

With proper mixing and good materials, a satisfactory concrete for bridge abutments can be framed from cement and broken stone, in the proportion of one, three and four. But it is recognized that the greatest strength in concrete can be obtained by making the mortar rich in cement, rather than lessening the quantity of stone. Nor beyond providing for a strong adhesion of mortar and stone, is there wisdom in making the mortar materially stronger than the stone. This applies to crushing strength, however, rather more than to the tensile strength required to some extent in the arch. For the arch proper, it will be well to use a rich concrete, in say the proportions of one of cement, two of sand, and three of broken stone. With small arches there will be little economy in changing the proportions for the abutments.

The cost of the abutments may be lessened, where they are of sufficient thickness, by the use of rubble concrete. The timber casing, or curbing, must, of course, be built up as the laying of the arch proceeds. Within the casing, and firmly tamped against it, there should be placed fine concrete to a thickness of about six inches. This will form a shell for the abutment, inside of which large stones may be placed in rock-and-pinion order, ends up. There should be a space of at least two inches between the stones, filled with fine concrete, and all firmly rammed. The outer shell of fine concrete should always be kept built up six inches or so in advance of the rubble work. This should be laid in layers, and each layer well flushed with a layer of fine concrete. The lumber used in making the curbing or casing, should be dressed, tightly fitted and firmly braced, so that the concrete may be well rammed into place. The exterior of the culvert when finished, should have a smooth face, free from holes; and a surface coating, which is of little use, should not be necessary. The arch centre should be firmly put in place, and should not be removed for at least two weeks after the completion of the arch.

There is some discussion at present as to the relative strengths of gravel and broken stone in concrete, without any decisive results in either case; although the natural inference it to suppose that a rough, irregular surface will secure greater adhesion than one that is smooth. However that may be, there is little reason to doubt that gravel will make a good concrete. But there is a right and wrong way of using gravel. It is not uncommon to find cement, and gravel just as it is taken from the pit, mixed to form a concrete. Remembering the proper composition of a concrete, and placing beside this the fact that gravel usually contains sand, but not in any definite proportions, that some pockets of "gravel" may be almost completely sand, while in the layers adjoining there may be little if any sand, it will be readily understood why it is that, in some cases, concrete mixed in this way may be successful, yet it will always be uncertain and hazardous. The only safe method is to separate the stone and sand composing the gravel by screening, then to mix cement, sand and stone, uniformly and in their right proportions.

A cause of poor concrete is the excessive amount of water used when mixing. The tendency very often is to bring concrete to the same consistency as common mortar, a very great mistake. Concrete when ready to be placed in the work should have the appearance of freshly dug earth. Where an excessive amount of water is used, the hardened concrete will have an open, spongy texture. The concrete should be mixed close to the work, in a box, which is sometimes specified as watertight, but the concrete will soon make it so. It should be mixed in just such quantity as is required, and a constant stream kept passing to the work. It should be laid in layers, and each layer thoroughly rammed until moisture appears on the surface.

It is very necessary to see that the sand and stone used in making the concrete are clean, that is, free from clay, loam, vegetable or other matter which will act as an adulterant, and result in a weak and friable concrete. If such matter is intermixed with the stone, it is well to flush it away with a good stream of water. Large stone used in rubble concrete should also be treated in this way. Indeed, it is well, particularly in hot weather, to dampen the stone before mixing it with the mortar. The stone in hot weather causes the moisture of the mortar to evaporate, with the result that it sets too quickly; and at all times there is more or less absorption from the mortar in immediate contact with the stone, unless the stone, as intimated, has been previously dampened.

When the work ceases for the day, or is for other reasons interrupted, the surface should be kept damp until work is resumed. When work is in progress in hot weather, any exposed surfaces should be kept damp and protected from the rays of the sun; otherwise the surface will, in setting too rapidly, be interlaced with hairlike cracks, which filling with water in winter, and freezing, will cause the surface to scale off. The same scaling sometimes results from laying concrete in frosty weather.

Arch culverts of masonry or concrete fail frequently from settlement, caused by an insecure foundation. The foundation should always be of at least sufficient depth to be free from any danger of undermining by the scour of water, and of sufficient further depth to be safe from settlement.

The one element in the construction of concrete work which presents a real difficulty, is the uncertainty with regard to the quality of the cement. The means of performing complete tests are not within the reach of small municipalities, and they are dependent upon the good reputation of the brand employed. Different batches of cement of the same brand differ, as we know, in quality, and sometimes very much to the disadvantage of the user. A brand may be, in general, good. And yet there are lapses now and then, a little carelessness in chemistry perhaps, which cause an occasional lot to be unfit for use. This is a disadvantage which small municipalities have at present to meet; yet it is one which, I feel confident, is growing less, and will continue to grow less as experience in the manufacture of cement reaches a more definite stage. Its use in the construction of highway culverts is a matter with which every member of the Association engaged in municipal work should fully acquaint himself.

DISCUSSION.

This paper is not given the same title as the programme gives it, but that is very frequently the case with papers. It is entitled, "Cement Concrete Culverts."

Mr. Ross—We have this paper before us. I think it is a most seasonable one, and one which, I think, will be of value to nearly every member of our Association. Mr. Campbell was over the ground very thoroughly, and I do not know that there is very much to criticize or add to what he has said; but we would be very glad to hear our members in regard to the paper.

Mr. Sankey—Concrete is now very generally taking the place of stone, especially where stone is difficult to get. In some parts of the country suitable stone for the work is not very plentiful or readily got at. I can vouch for what Mr. Campbell says about the same brand of cement differing most seriously. In Toronto we use an enormous amount of cement in the city works, and it takes a young man nearly his whole time sampling the cement and testing it. We have samples continually taken from the cement delivered by the contractors on the pavement work to see whether the cement he is using can stand the test. Of course, when the contract is let the specification provides that the cement must stand a certain test. Then each barrel must be carefully tested during the progress of the work to see that it is up to the standard; and in some cases the manufacturers of the cement themselves will not believe when we report that the cement is not up to the standard. They will tell us it is off the same batch, the same burning, and prepared with the same care. We tell them to come and see what has been broken and the official record of those who have broken it, and they will hardly believe their own eyes

Mr. Niven—I do not know enough about such matters to criticize, but I think this is a good paper. There is one thing certain, that some other than wooden culverts must be used, because in many parts of the country it is impossible to get the timber for a wooden culvert, as there is no earthly use in putting in anything but cedar, other timber will only last a few years; and if these cement culverts could be established for the country roads and water courses where they are necessary it would be a great boon.

Mr. Ross—Quite a boon to the path-masters; they would not have to be replacing broken planks.

Mr. Sankey—There is a company known as the Metal Company with the object of introducing this class of structure. They have the most modern machinery for producing the metal. They take sheets of steel of suitable strength, and it is stamped, and when it comes through a stamp it looks like a large fisherman's net. This is used for the strengthening of all concrete work. Quite recently, I understand, they have put up a factory in Montreal. They have carried on some very extensive tests, and the results have been astonishing.

Professor Stewart—The testing of cement at the School of Science is not in my department, but in that of Mr. Wright. In connection with this I was in Peterboro' about a year ago, and met the gentleman who has charge of the cement works on the Trent Valley canal, and he showed me some specimens of concrete that had been broken off after it had set and hardened thoroughly, and I was astonished at the strength shown by the cement in this broken concrete. It had been broken, I think, by a sledge hammer, and in breaking, instead of the stone separating from the cement, it had broken as if it were a mass of rock instead of a mixture of gravel, broken stone and cement.

Mr. Wilkie—I had a little experience with Portland cement last year. I found that a few barrels were not up to the standard at all. It did not set for thirty-six or forty hours; it was a slow-setting cement. A few weeks after it was apparently as hard as any of the other cements. The manufacturers would have declared that it was exactly the same—no difference whatever. In using Portland cement we cannot be too careful in watching it, and we will get the best results from it.

Mr. Ross—Reliable manufacturers in Canada make very trying tests of the goods they turn out, both chemically and mechanically, and do not send out anything but what they consider first-class in every respect. But I suppose there are some manufacturers not reliable.

Mr. Sankey—With regard to the different brands of cement at present in use in Toronto, we are constantly getting letters from different parts of the country asking how a certain brand has stood our tests, and what test it has stood; and I know the City Engineer is very happy to give any results of his investigation. Of course, in small places the test requires somewhat too expensive machinery, and it also requires personal knowledge to test cement. If any gentleman desires to know what test any particular brand has stood, it is quite easily got by applying to the City Engineer. It might be useful to gentlemen to know in making specifications what cement to call for.

Mr. McLean—In New York city I see the City Engineer has issued a circular, saying that he will conduct any tests that may be asked for by any other municipalities, and will report the result on any of the cements. I do not know whether a thing of that kind could be undertaken here at any of the schools.

Mr. Ross—Do you charge a fee for testing cement?

Mr. Stewart—I think a small fee is charged for making tests.

Mr. Ross—A fee of about $10?

Mr. Stewart—I think it is $5.

Mr. Ross—A testing machine can be purchased from the Fairbanks Company for $130. Those engineers who have only a small amount of work to do would hardly invest in one; but it would no doubt be very helpful for every engineer who has anything to do with cement construction to have one.

Mr. Stewart—The machine used at the school is one made in Philadelphia. It is a 2,000 pound machine, and appears to be very simple in its mode of operation.

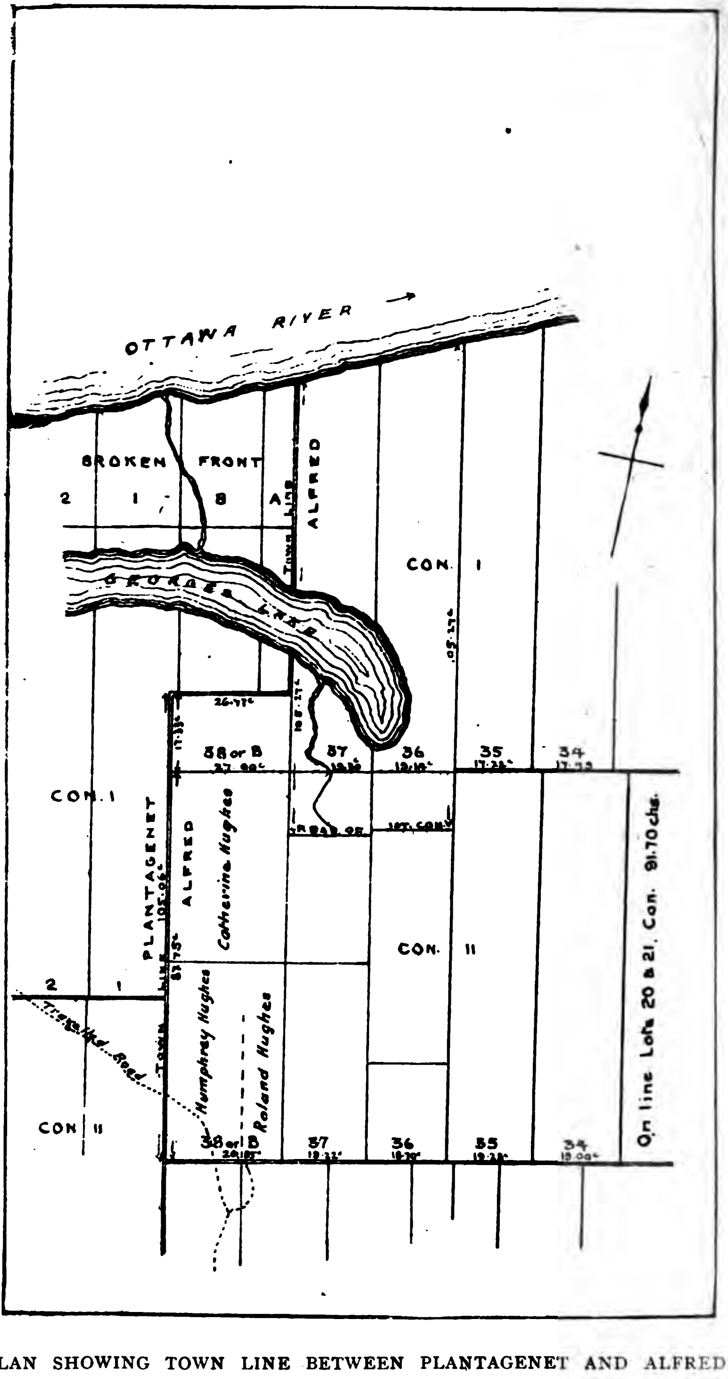
[*This Association is not responsible as a body for the opinions expressed in its Papers by Authors.*]

SOME NOTES ON THE ORIGINAL SURVEY OF PART OF ALFRED TOWNSHIP.

BY E. T. WILKIE, CARLETON PLACE.

In December, 1898, I was called upon to make a survey of a piece of land in the Township of Alfred, for the purpose of enabling the owner, or rather the squatter, to get a patent for the land in question. I was informed that he had applied to the Crown Lands Department for a patent, and was told that they were not aware that there was any land in that vicinity unpatented, and was instructed to have the piece of land surveyed, and to send the plan and field notes to the Crown Lands' Office, in the usual way, and the land would be patented to him. Hence the survey.

I found that the original survey of the first three concessions of Alfred had been made by Deputy Surveyor J. Fortune, in 1816. In doing the work, which appears to have been done in the summer time, he seems to have started his work at the east side of the township. His notes show that he ran the line in front of the second concession as far as the line lots 20 and 21, there he offset "North 16 deg. west, 104.60 to the Grand River (Ottawa River), in order to run the first short line." Then he ran the line in front of the first concession westward, till he ran into the Grand or Ottawa River, and by making a couple of offsets southwards, to keep out of the river, he got across lot 37. There he established the town line between Alfred and Plantagenet, or as he calls it, "The western boundary line of the Township of Alfred." Then he ran south 16 degs east along this boundary line, "In order to ascertain the distance for to commence the second concession line," but he did not get more than half the distance he wanted till he ran into George's Lake, he then offset eastwards, across lot 37, and again ran south 16 degs. east, and ran into the lake again, and by making a couple more offsets he reached the second concession line, along which he ran eastwards, and appears



PLAN SHOWING TOWN LINE BETWEEN PLANTAGENET AND ALFRED.
ACROSS 1ST AND 2ND CONS. ALFRED.

to have struck the point where he stopped the line, between lots 20 and 21, exactly, both for longitude and latitude. Then he appears to have run the line along the front of the third concession from the east side of the township westwards and established the western boundary line of the Township of Alfred south of George's lake, by chainage along that line.

Deputy Surveyor Duncan McDonnell was there in 1836. He seems to have found the line between the second and third concessions of Alfred ran out to the western boundary line. He then ran this boundary line between Alfred and Plantagenet (which he may have found ran as far north as the rear of the first concession of Plantagenet), northwards for 105.27 chains, from which point he ran a line eastwards, parallel to the line between the second and third concessions of Alfred, till he intersected Fortune's town line from the Ottawa River to George's Lake, produced southwards across the lake, which made the town line as I found it and as shown on the accompanying plan.

Some years after McDonell made his survey, W. McConnell, from the Province of Quebec, picked up Fortune's line for the front of the second concession, at the post between lots 35 and 36, the first post he set after offsetting round the lake, and produced it westwards across lots 36, 37 and the commons, or (38 or B.), till he intersected McDonell's town line. The portion cut off from the commons or (38 or B.) north of this line, said to contain about forty acres, was the land I was required to survey.

The lands adjoining this town line, in the broken front and first concession of Plantagenet, were patented to The Canada Company, who sold them, describing them by metes and bounds. Part of the description of the commons in the first concession adjoining the eastern boundary of Plantagenet is "Commencing at the water's edge of the Ottawa River, in the western limit of the allowance for road between the Townships of Alfred and Plantagenet, thence south 14 degs., east, 70.38 chains, more or less, to a line run by Deputy Surveyor Duncan McDonell, in 1836, parallel to the line between the second and third concessions of Alfred." Fortune gives the bearing of the line as south 16 degs. east, and I made the distance 70.50 chains, from the line of vegetable growth along the river to McDonell's post.

Lots 36 and 37 in the first concession of Alfred were patented in 1802 and 1803, respectively, fourteen and thirteen years before Fortune made his survey, each lot being described by metes and bounds, and having side lines south 16 deg. east, the same bearing as Fortune's town line from the Ottawa River to George's Lake, running southwards 105.27 chains from the river, and being 19.22 chains wide. The south half of lot 37 in the second concession of Alfred was patented to Humphrey Hughes, October 15, 1830, as 100 acres, and described by metes and bounds, being 52.63½ chains, more or less, deep, and refers to the adjoining lot on the west side as "Commons." The front or northerly part of lot 37 in the second concession of Alfred was patented to Catherine Hughes, June 25, 1846, as sixty acres and described by metes and bounds, and being 31.60 chains, more or less, deep. Lot 36, in the second concession of Alfred was patented to Rowland Hughes in two pieces, the north or centre vacant part, on October 15, 1830, as 100 acres, described as commencing on the limit between lots 35 and 36, at the distance of 26.31¾ chains from the north-east angle of said lot 36, thence south 16 deg., east 52.63½ chains, etc., the south part, on Aug. 27, 1844, as fifty acres, more or less, and described as commencing in the limit between lots 35 and 36, distant 78.95¼ chains, on a course south 16 deg. east, from the north-east angle of said lot 36, thence south 16 deg., east, 26.31¾ chains, more or less, to the allowance for road in rear of said concession, etc.

It will be seen from the distances given in these patents that the Crown Lands Department believed the concession was 105.27 chains deep, but I only found 87.73 chains from Fortune's second line produced westward to the western boundary and the third concession line. In a former survey I found on the line between lots 20 and 21, the concession to be 91.70 chains wide.

Humphrey Hughes and Catherine Hughes supposed that lot 37 lay adjoining the western boundary of the township and located themselves accordingly, and made their clearings and built their houses and other buildings close to the western boundary line, and they and their descendants are in possession there still. Rowland Hughes, in locating the western boundary of his land measured eastwards along the line between the second and third concessions from the western boundary line of township, the distance given in the patent, of lot 37 as its width, and he or his descendants are in possession of a strip of the commons, or 38 or B., as shown by the lines which were run afterwards, and as shown on the accompanying plan.

The whole commons, or 38 or B., contains about 277 acres, and at the time I was there none of the occupants had any title to their holdings.

I made my survey, sent my plan and field notes to the solicitor through whom I was engaged to make the survey, who forwarded them to the Crown Lands Department, and I have since been informed that the patent has been issued.

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MEASURING THE DISCHARGE OF RIVERS AND STREAMS AND CALCULATING HORSE POWER.

By VAUGHAN M. ROBERTS.

The development of the natural resources of Ontario has proved to surveyors the necessity of having, in addition to the requirements called for by the "Survey Act," a fair knowledge of more than one branch of civil engineering.

The increasing value of water-powers must, if it has not already done so, compel the Government to issue instructions to all surveyors making government surveys, to measure and report upon all water-powers which may be met with in the course of their surveys.

During the past few months the writer has been so frequently asked the question: "How do you measure the discharge of a river and calculate horse-power?" that an endeavor to answer it in the form of a paper may bring about a discussion which will be beneficial to all.

In finding the discharge of a stream it is necessary to know the area of its wetted perimeter in square feet and its velocity in feet per minute.

In calculating horsepower it is necessary to know the discharge of stream, and the height of fall over which it is discharged.

To obtain the velocity of a stream or river:

1. Select a stretch or reach where the channel is uniform.

2. Lay off a base line along the bank of the river, not less than one hundred feet in length, setting pickets at each end of it; on the opposite bank of the river and at right angles to the base line set two more pickets, one opposite each end of the base line.

3. Take soundings across the river at each end of the base line and one or more in between, according as the length of

the base line and the irregularities of the bed of the river may require, from the cross sections obtained by plotting the soundings, the average area of the wetted perimeter may readily be calculated. When taking soundings, it is always advisable to fix the level of the water by connecting it with some permanent bench mark.

4. Make a series of floats of different lengths; to the end of each fasten a small twig about the thickness of a lead pencil and eighteen inches long, to which attach a piece of paper or flannel; on the other end fasten sufficient weight to submerge the whole float, leaving above water the small twig with paper or flannel flag. Place the floats in the river at different distances from the banks, and above the upper line of pickets; note the time they pass the line of pickets at each end of the base line. If there is any great difference in the time taken going over the course, a second and even third trial should be made and the results thus obtained averaged and reduced to feet per minute.

In measuring velocity, dead water is often found adjacent to each bank of the river and an allowance should be made for this in the area of the wetted perimeter.

The area of the wetted perimeter is the sectional area of the volume of water moving down stream and the velocity is the number of feet this sectional area travels in one minute, the product of the velocity and wetted perimeter is therefore the discharge.

After a number of experiments, James Watt found that the average value of a horse-power was 33,000 foot-pounds per minute, and it is now the recognized unit of horse-power. One horse-power is a force which will raise 33,000 pounds vertically one foot in one minute.

To calculate the horse-power of a river at a fall, it is necessary to know the height of fall, *i.e.*, the difference in level between the slack water above the fall and the slack water below the fall, and the weight of the volume of water flowing over the fall.

A cubic foot of water weighs 62.4 pounds. The formula for horse-power is therefore:

$$\text{One Horse Power} = \frac{\text{Discharge in cubic feet per second} \times 62.4 \text{ lbs.} \times 60 \times \text{head in feet}}{33000}$$

$$\text{But } \frac{62.4 \times 60}{33000} = .1134 \therefore \text{ one Horse Power} = \text{Discharge in cubic feet per second} \times \text{head in feet} \times .1134$$

As an example, we will take the Sturgeon River, in the District of Nipissing, which I have measured on several occasions. The length of base line was 300 feet, the sectional area obtained by soundings, allowance being made for dead water, was 5,900 square feet, the velocity of stream taken by submerged floats, three trials being made (the length of the floats being about two-fifths the depth of water), was .375 feet per second.

The discharge of the river was therefore 5,900 sq. ft. × .375 ft. per sec. = 2,212.5 cu. ft. per sec., the head was 40 feet.

Horse-power = 2,212.5 × 40 × .1134 = 10,035.9.

DISCUSSION.

Mr. Ross—Mr. Robert's paper is before you for discussion. It is quite a clear, simple and reasonable paper, and we might have a short discussion on it.

Mr. Speight—This is certainly a good, practical paper. These matters are coming very much to the front during the past year, as the Local Governments are placing considerable weight upon water powers in Ontario, and I think it is a very good thing they are, and the ordinary surveyor will have no difficulty in working out the problem. I hope that it will be helpful to all of us.

Mr. Van Nostrand—I claim a little of the credit of instigating this paper, because I had occasion to look into a matter of that kind for a small calculation of water power, and I did not know exactly how to go about it in the best practical way; and, knowing that Mr. Roberts had recently had experience of this kind, I asked him to explain it, and he explained it so lucidly that I thought it would be a good thing to have it put in a paper.

There are very many practical hints in it; and I understand from Mr. Roberts that the results have stood the tests of calculation by some very prominent engineers, and his method was upheld, although differing in results from the other people, they afterwards came to his way of thinking.

Mr. Niven—It is a very practical and useful paper. It is one, too, which should be used on surveys, for surveyors run across water power, and it would be a very good thing to know what the volume is, and all about it. It does not appear to be a very difficult process; any person could easily pick it up and use it. I move that it be received and printed in the Proceedings.

Mr. Speight—I second that motion.

LIST OF MEMBERS.

31st July. 1900.

The names of those members granted exemption by By-laws ratified by the Association are marked*.

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Abrey, George Brockitt, Ignace, Dist. of Rainy River D.L.S.	10th Jan., 1860
Allan, John Richard, Renfrew Grad. S.P.S.	6th Nov., 1894
Aylsworth, Charles Fraser, Jr., Madoc D.L.S.	8th Jan., 1886
Aylsworth, John Sidney, Selby, P.O. Box 23 D.L.S.	9th Jan., 1871
Aylsworth, William Robert, Belleville, P.O. Box 2 D.L.S.	8th Nov., 1861
Baird, Alexander, Leamington D.L.S., C.E.	7th July, 1877
Barrow, Ernest George, Hamilton D.L.S., Mem. Can. Soc. C.E., City Engineer.	4th Oct., 1877
Bazett, Edward, Burk's Falls D.L.S.	8th July, 1881
Beatty, David, Parry Sound D.L.S.	12th July, 1869
Beatty, Herbert John, Eganville Grad. S.P.S.	8th Nov., 1893
Beatty, Walter, Delta D.L.S., M.P.P.	19th July, 1858
Bell, James Anthony, St. Thomas D.L.S., Co. Engineer, Elgin. City Engineer, St. Thomas.	11th Oct., 1875
Bigger, Charles Albert, Ottawa, 68 Daly Ave.	6th Jan., 1882
Bolger, Thomas Oliver, Kingston D.L.S., City Engineer.	6th July, 1865
Bolton, Ellsworth Doan, Listowel B.A.Sc. (McGill)	7th Nov., 1899
Bolton, Jesse Nunn, Toronto, 264 Major St D.L.S.	6th April, 1867
Bolton, Lewis, Listowel D.L.S.	9th July, 1864

NAME AND P.O. ADDRESS. DATE OF ADMISSION BY BOARD.

Boswell, Elias John, Peterborough..........7th Nov., 1896
Grad. S.P.S.

Bowman, Clemens Dersteine, West Montrose. 10th July, 1879

Bowman, Herbert Joseph, Berlin.............7th Jan., 1887
D.L.S., Grad. S.P.S., Treasurer County Waterloo. Assoc. Mem. Can, Soc, C,E,

Bray, Edgar, Oakville.......................6th Oct., 1866
D.L.S.

Bray, Harry Freeman, Oakville.............10th July, 1882

Bray, Samuel, Ottawa, Dept. of Indian Affairs..6th Jan., 1877
C.E., D.L.S.

Brown, George Laing, Morrisburg..........19th Feb., 1898
Grad. S.P.S.

*Brown, John Smith, Kemptville.............8th July, 1852
D.L.S.

Browne, Harry John, Toronto, 18 Toronto st..6th Julv. 1872
C.E.

Browne, William Albert, Toronto,
18 Toronto st.........................10th April, 1876

Burt, Frederick Percy, New York, N.Y.......8th July, 1885
Manager and Treasurer Engineering News Pub. Co., 220 Broadway.

Butler, Matthew Joseph, Napanee,
P.O. Box 359........................11th Jan., 1878
M.I.C.E., Mem. Am. Soc. C.E., Mem. Can. Soc. C.E., C.E.

Byrne, Thomas, Sault Ste. Marie............15th July, 1862
D.L.S.

Caddy, Cyprian Francis, Campbellford.......10th July, 1860
D.L.S.

Caddy, John St. Vincent, Ottawa, 559 King st..6th Oct., 1866
D.L.S.

Cameron, Alfred John, Peterborough........9th April, 1889

Campbell, Archibald William, Toronto,
Parliament Building ....10th April, 1885
C.E. Provincial Instructor in Road Making.

Carpenter, Henry, Stanley, B.A., Sc.
(Toronto Univ.), Collingwood.................25th Feb., 1899

Carre, Henry, Belleville, P.O. Box 203.......8th Nov., 1861
City Engineer, B.A. and C.E. (Trin. Coll., Dublin), D.L.S.

Carroll, Cyrus, Prince Albert, Sask...................10 Jan., 1860
Mem. Can. Soc. C.E., D.L.S.

Casgrain, Joseph Philippe Baby, Morrisburg...5th Jan., 1887
D.L.S., P.L.S., (Que.) C.E., Assoc. Mem. Can. Soc., C.E., Chief Eng.
M. & P.J. Ry.

Cavana, Allan George, Orillia................8th July, 1876
D.L.S.

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Chalmers, John, Port Arthur, per Ont. & R.R. R'y Co. Grad. S.P.S.	14th April, 1896
Charlesworth, Lionel Clare, Rat Portage Grad. S.P.S, Agent Bureau of Mines, (Ont.)	14th April, 1896
*Cheesman, Thomas, Mitchell D.L.S.	11th July, 1856
Chipman, Willis, Toronto, 103 Bay st B.A. Sc. (McGill), Mem. Am. Soc., C.E.; Mem. Can. Soc. C.E.	4th Oct., 1881
Code, Abraham Silas, Alvinston	14th April, 1896
Cozens, Joseph, Sault Ste. Marie D.L.S.	7th July, 1875
*Davidson, Alexander, Arkona D.L.S.	11th Oct., 1858
Davidson, Walter Stanley, Sarnia	9th April, 1884
Davis, Allan Ross, Napanee B.A.Sc. (McGill.)	8th Jan., 1886
Davis, John, Alton	5th April, 1878
Davis, William Mahlon, Berlin Grad. R.M.Coll., (Kingston), Town Engineer.	11th April 1885
Deacon, Thomas Russ, Rat Portage Grad. S.P.S., Town Engineer, Mgr. Mikado Mine.	12th Nov., 1892
Deans, William James, Oshawa	11th July, 1884
DeMorest, Richard Watson, Sudbury M.E.	9th April, 1889
Dickson, James, Fenelon Falls D.L.S.	6th April, 1867
Dobbie, Thomas William, Tilsonburg D.L.S.	11th July, 1856
Dobie, James Samuel, Port Arthur B.A.Sc. (Toronto Univ.)	21st Feb., 1898
Doupe, Joseph, Winnipeg, Man., 169 Edmonton st D.L.S., P.L.S. (Man.), C.E. (McGill).	13th Jan., 1863
Ducker, William A., Winnipeg, Man., 334 Pacific ave D.L.S., P.L.S. (Man.) Swamp Lands Com.	6th April, 1882
Esten, Henry Lionel, Toronto, 157 Bay st	7th Jan., 1887
Evans, John Dunlop, Trenton D.L.S., C.E., Chief Eng. Cent. Ont. Ry., Eng. for Weddell Bridge & Engine Works.	8th July, 1864
Fair, John, Brantford	13th April, 1875

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Fairbairn, Richard Purdom, Toronto, 127 Major st. Surveyor for Dept. of Pub. Works, Ontario.	7th Oct., 1876
Fairchild, Charles Court, Simcoe Grad. S.P.S.	9th April, 1894
Fairchild, William Howard, Simcoe	17th Feb., 1900
Farncomb, Alfred Ernest, Fort William	9th April, 1895
Farncomb, Frederick William, London, 213 Dundas st	6th Nov., 1889
Fawcett, Thomas, Niagara Falls Dom. Topographical Surveyor.	6th Jan, 1881
Fitton, Charles Edward, Orillia, Box 142 D.L.S.	10th April, 1879
FitzGerald, James William, Peterborough, Box 333 D.L.S.	13th July, 1857
Flater, Frederick William, Petrolea	9th April, 1888
Ford, William Butterton, Hamilton, 42 James St., N	21st Feb., 1898
Francis, John James, Sarnia P.O., Box 304 D.L.S.	16th Oct., 1861
*Fraser, Charles, Wallaceburg D.L.S.	5th Aug., 1847
Galbraith, William, Bracebridge D.L.S.	4th April, 1883
Gamble, Killaly, Toronto, 88 Charles st D.L.S., P.L.S. (Man.), Captain R.A. (Ret'd)	6th April, 1888
Gardiner, Edward, St. Catharines D.L.S.	6th Jan., 1866
Gaviller, Maurice, Collingwood, Box 164 C.E. (McGill), D.L.S.	6th Jan., 1866
Gibson, Harold Holmes, Willowdale	8th Sept., 1891
*Gibson, James Alexander, Oshawa D.L.S.	7th April, 1855
Gibson, Peter Silas, Willowdale C.E., M.S. (Mich. Univ.) D.L.S., Mem. Can. Soc. C.E., Engineer Tp. of York.	19th July, 1858
Gibson, Wilbert Silas, Willowdale	21st Feb., 1898
Gillon, Douglas John, Fort Frances Grad. R.I.E. Coll.	9th Nov., 1895
Graydon, Aquila Ormsby, London City Engineer.	8th July, 1880

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Griffin, Albert Dyke, Woodstock, P.O. Box 612	11th Nov., 1890
Hanning, Clement George, Preston, Lock Box 130 D.L.S., C.E. (Trin. Coll., Dublin).	19th July, 1858
Hart, Milner, Toronto, 103 Bay st D.L.S.	11th July, 1863
Harvey, Thomas Alexander, Steelton, Penn. C.E. (R.P.I., Troy, N.Y.)	13th Nov., 1893
Heaman, John Andrew, London, Albion Building	16th Nov., 1896
Henry, Frederick, London, Albion Building	7th April, 1887
*Hermon, Royal Wilkinson, Rednersville D.L.S.	13th July, 1857
Hobson, Joseph, Montreal, G. T. Ry. Office D.L.S., Chief Eng. Grand Trunk Railway System.	3rd Oct., 1855
Hopkins, Marshall Willard, Rat Portage B.A.Sc. (McGill), Assoc. Mem. Can. Soc. C.E., Chief Engineer I.R.R.C.	13th Nov., 1893
Hutcheon, James, Guelph Grad. S.P.S., City Engineer.	10th Nov., 1891
Irwin, James Moore, Rat Portage D.L.S.	13th Jan., 1863
James, Darrell Denman, Toronto, 77 Victoria St B.A., B.A.Sc. (Toronto Univ)	3rd Nov., 1891
Jones, Charles Albert, Petrolea D.L.S.	8th April, 1881
Jones, John Henry, Sarnia, Box 194 D.L.S.	10th Oct., 1886
Jones, Thomas Henry, Brantford B.A.Sc. (McGill). D.L.S., City Engineer.	10th Oct., 1878
*Keefer, Thomas Coltrin, Ottawa D.L.S., C.E.	14th Aug., 1840
Kennedy, James Henry, St. Thomas C.E. (Toronto Univ.), Mem. Can. Soc. C.E., Engineer of V.V. & E. Ry.	7th April, 1887
Kippax, Hargreaves, Huron, South Dakota C.E. (Toronto Univ), Assistant to Surveyor-General.	7th July, 1877
Kirkpatrick, George Brownly, Toronto, Dept. of Crown Lands D.L.S., Director of Surveys.	13th April, 1863
Laird, James Stewart, Essex D.L.S.	6th April, 1867

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Laird, Robert, Rat Portage Grad. S.P.S.	11th Nov., 1887
Lewis, John Bower, Ottawa, Brunswick House D.L.S., P.L.S. (Quebec), C.E.	4th Oct., 1883
Lougheed, Aaron, Port Arthur, D.L.S.	12th Nov., 1888
*Low, Nathaniel Edward, Wiarton D.L.S.	11th July, 1856
Lumsden, Hugh David, Toronto, 63 Homewood ave C.E., D.L.S., M.I.C.E., Mem. Can. Soc. C.E.	4th Jan., 1866
Macdougall, Allan Hay, Port Arthur D.L.S., Town Engineer.	11th April, 1859
MacKay, James John, Woodstock	25th Feb., 1899
MacKenzie, William, Sarnia Grad. R.M.C. (Kingston).	11th April, 1896
MacKenzie, William Lyon, Cranbrook, B.C C.E.	7th April, 1887
MacPherson, Duncan, Montreal, P.Q Grad. R.M.C., M.I.C.E., Mem. Can. Soc. C.E., Div. Eng. Eastern Div. C.P. Ry.	9th Jan., 1884
McAree, John, Rat Portage Dominion Topographical Surveyor, B.A.Sc., (Toronto Univ.)	6th April, 1867
McCubbin, George Albert, St. Thomas, City Engineer's Office Assist. City Engineer.	9th Nov., 1895
McDonell, Augustine, Chatham, 4 & 5 Ebert's Block D.L.S.	11th July, 1863
McDowall, Robert, Owen Sound Grad. S.P.S., Town Engineer	11th Nov., 1890
McEvoy, Henry Robinson, St. Marys D.L.S.	10th July, 1875
McFadden, Moses, Neepawa, Man D.L.S., P.L.S. (Man.)	13th April, 1858
McFarlen, George Walter, Toronto, Court House Grad. S.P.S.	11th Nov., 1889

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
McGeorge, William Graham, Chatham, Box 225 D.L.S.	8th Jan., 1866
McGrandle, Hugh, Huntsville D.L.S.	5th Jan., 1883
McKay, Owen, Windsor, P.O. Box 167 Grad. S.P.S., Chief Eng. D. & L. E. Ry.	7th Jan., 1887
McKenna, John Joseph, Dublin D.L.S.	9th July, 1860
McLatchie, John, Nelson, B.C., P.O. Box 128 D.L.S., P.L.S. (Que., Man. and B.C.).	9th Jan., 1864
McLean, James Keachie, Elora D.L.S.	8th April, 1876
McLean, William Arthur, Toronto, Parliament Buildings Secretary of Roads.	21st Feb., 1898
McLennan, Murdoch John, Williamstown B.A.Sc. (McGill), D.L.S.	13th Nov., 1893
McLennan, Roderick, Toronto, 115 Avenue Rd D.L.S.	20th June, 1846
McNab, John Duncan, Owen Sound	9th Oct., 1879
McNaughton, Finlay Donald, Cornwall	25th Feb., 1899
McPherson, Archibald John, Brockville B.A.Sc. (Toronto Univ.)	10th April, 1897
McPherson, Charles Wilfrid, Barrie	21st Feb., 1899
McPhillips, George, Windsor D.L.S., P.L.S. (Man.)	9th July, 1885
Manigault, William Mazyck, Strathroy, P.O. Box 300 D.L.S.	8th July, 1876
Marshall, James, Holyrood D.L.S.	6th Oct., 1866
Meadows, William Walter, St. Thomas Grad. S.P.S.	21st Feb., 1898
Miles, Charles Falconer, Rat Portage, Hilliard House D.L.S.	13th Jan., 1862
Miller, Frederick Fraser, Napanee	8th Jan., 1885
Moore, John MacKenzie, London, Albion Building	9th Oct., 1879
Moore, John Harrison, Smith's Falls Grad. S.P.S.	11th Nov., 1889

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Morris, Alfred Edmund, Perth	10th April, 1879
Morris, James Lewis, Pembroke D.L.S., C.E. (Toronto Univ	7th July, 1886
Mountain, George Alphonse, Ottawa Mem. Can. Soc. C.E., D.L.S., P.L.S. (Que.) Chief Eng. Can. Atlantic and O.A. & B. Ry.	9th Jan., 1884
Murdoch, William, Toronto, 37 Bloor St. E. D.L.S., C.E.	10th Jan., 1860
Murphy, Charles Joseph, Toronto, 157 Bay st.	6th Oct., 1886
Newman, John James, Windsor	21st Feb., 1898
Newman, William, Windsor, 57 Sandwich st. w Grad. S.P.S.	12th Nov., 1892
Niven, Alexander, Haliburton D.L.S.	8th July, 1859
Ogilvie, William, Dawson City, Yukon Dist. D.L.S. Commissioner for Yukon District.	12th July, 1869
O'Hara, Walter Francis, Chatham D.L.S.	14th April, 1892
Paterson, James Allison, Sauzon, P.Q. C.E., Mem. Can. Soc. C.E.	5th April, 1878
Patten, Thaddeus James, Little Current	5th Jan., 1883
Peterson, Peter Alexander, Montreal, P.Q. D.L.S., C.E., Mem. Can. Soc. C.E., Chief Engineer Can. Pac. Ry.	16th July, 1863
Pinhey, Charles Herbert, Ottawa, 630 Wellington ave D.L.S., Grad. S.P.S., Assoc. Mem. Can. Soc. C.E.	12th Nov., 1888
Proudfoot, Hume Blake, Port Arthur D.L.S., C.E. (Toronto Univ.)	6th Jan., 1882
Rainboth, Edward Joseph, Ottawa D.L.S.	11th Nov., 1887
Rainboth, George Charles, Aylmer, P.Q. D.L.S., P.L.S. (Que.)	11th July, 1868
Reinhardt, Carl, Montreal, 340 Mountain St. B.A.Sc. (McGill.)	25th Feb., 1899
Reynolds, Samuel Henry, Rat Portage	17th July, 1880
Roberts, Vaughan Maurice, St. Catharines	5th April, 1887
Robertson, James, Glencoe Grad. S.P.S.	11th July, 1885
Robinson, Franklin Joseph, Barrie Grad. S.P.S.	21st Feb., 1898
Roger, John, Mitchell Grad. S.P.S.	10th Nov., 1888

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
*Rombough, Wm. R., Toronto, 61 Walton St. D.L.S.	14th Nov., 1848
Rorke, Louis Valentine, Sudbury D.L.S.	14th April, 1890
Ross, George, Welland B.A.Sc. (McGill), D.L.S.	10th July, 1879
*Rubidge, Tom S., Cornwall D.L.S., Asst. Eng. Dept. Rys. and Canals.	9th Feb., 1849
Russell, Alexander Lord, Port Arthur D.L.S., P.L.S. (Que.).	16th April, 1873
Sankey, Villiers, Toronto, City Hall D.L.S., City Surveyor.	11th Jan., 1878
Saunders, Bryce Johnston, Fort William B.A.Sc. (McGill), D.L.S.	7th Jan., 1885
Scane, Thomas, Ridgetown D.L.S.	7th Jan., 1865
*Schofield, Milton C., Guelph D.L.S.	28th Sept., 1843
Schwitzer, John Edward, Rat Portage B.A.Sc. (McGill.)	16th Nov., 1896
Seager, Edmund, Rat Portage D.L.S.	8th July, 1861
Selby, Henry Walter, Dinorwic, Dist. of Rainy River D.L.S.	8th Jan., 1876
Sewell, Henry DeQuincy, Rat Portage D.L.S.. A.M.I.C.E.	9th July, 1885
Shaw, John Henry, Pembroke Grad. S.P.S.	17th Feb., 1900
Silvester, George Ernest, Sudbury Grad. S.P.S	12th Nov., 1892
Sing, Josiah Gershom, Meaford, P.O. Box 3 D.L.S.	9th Jan., 1879
Smith, Angus, Stratford Grad. S.P.S., City Engineer.	14th April, 1896
Smith, George, Woodville, P.O. Box 77. Engineer for Co. Victoria and four Townships.	7th April, 1881
Smith, Henry, Toronto, Crown Lands Dept. D.L.S., Mem. Can. Soc C.E.	8th Nov., 1861
Speight, Thomas Bailey, Toronto, Yonge St. Arcade D.L.S.	6th Jan., 1882
Squire, Richard Herbert, Brantford, 103 Dalhousie St B.A.Sc. (Toronto University).	14th April, 1896
Steele, Edward Charles, Port Arthur Assoc. Mem. Can. Soc. C.E.	9th April, 1889

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Stewart, Elihu, Ottawa, Dept. of the Int. D.L.S., Chief Inspector of Timber and Forestry.	8th April, 1872
*Stewart, George Alexander, Calgary, Alta. D.L.S.	8th July, 1852
Stewart, John, Montreal D.L.S.	11th Nov., 1887
Stewart, Walter Edgar, Aylmer	12th April, 1892
*Strange, Henry, Rockwood D.L.S., C.E	30th Nov., 1838
Stull, William Walter, Sudbury B.A.,Sc. (Toronto Univ.)	17th Feb., 1900
Taylor, William Verner, Gananoque Grad. S.P.S.	7th Nov., 1896
Tiernan, Joseph Martin, Tilbury Centre	7th Jan., 1886
Traynor, Isaac, Dundalk D.L.S.	16th April, 1873
Turnbull, Thomas, Winnipeg, Man., C. P. R. Eng. Office D.L.S., C.E. (Toronto Univ.)	6th July, 1878
Tyrrell, James Williams, Hamilton, 42 James st. n. C.E. (Toronto Univ.), D.L.S., Co. Eng. for Wentworth.	8th April, 1885
*Unwin, Charles, Toronto, 126 Seaton st. D.L.S.	12th April, 1852
Ure, Frederick John, Woodstock C.E.	7th April, 1887
Van Buskirk., William Fraser, Rosland Grad. R. M. Coll., (Kingston), City Engineer.	7th April, 1888
Van Nostrand, Arthur J., Toronto, Yonge St. Arcade D.L.S.	30th Oct., 1882
Wadsworth, Vernon Bayley, Toronto, 103 Bay st. D.L.S.	9th April, 1864
Wagner, William, Ossowo, Man D.L.S.	13th April, 1858
Walker, Alfred Paverley, Toronto, Room 508, Union Station, C. P. Ry., Eng. Office D.L.S., Mem. Can. Soc. C.E.	6th Jan., 1882
Wallace, James Nevin, Hamilton, 119 Hunter St., N. B.A., B.E. (Trin. Coll. Dublin).	21st Feb., 1898
Ward, Archeson Thomas, Wabigoon Dist. of Rainy River	10th April, 1897

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Warren, James, Walkerton, P.O. Box 190 **D.L.S.**	7th Oct., 1864
Watson, John McCormack, Orillia, P.O. Box 224	13th April, 1892
*Weatherald, Thomas, Goderich, P.O. Box 273 **D.L.S., C.E.**	12th Jan., 1856
Weekes, Melville Bell, Brantford **B.A.Sc. (Toronto Univ.)**	17th Feb., 1900
West, Robert Francis, Orangeville	7th April, 1881
Wheelock, Charles Richard, Orangeville **Treasurer County of Dufferin.**	7th Jan., 1885
Whitson, James Francis, Toronto, Crown Lands Dept	9th Jan., 1886
Wicksteed, Henry King, Cobourg **D.L.S., C.E.**	7th Jan., 1886
Wiggins, Thomas Henry, Cornwall **Grad. S.P.S., D.L.S., Town Engineer.**	10th Nov., 1891
Wilde, John Absalom, Sault Ste. Marie	9th April, 1889
Wilkie, Edward Thomson, Carleton Place **D.L.S.**	11th April, 1891
Williams, David, Fort William West **D.L.S.**	9th April, 1864
*Winter, Henry, Thornyhurst **D.L.S., C.E.**	11th July, 1853
*Wood, Henry O., Billings' Bridge **D.L.S.**	10th Oct., 1855
*Yarnold, William Edward, Port Perry, P.O. Box 44 **D.L.S.**	7th April, 1854

REGISTERED AND WITHDRAWN.

The names of those who have become "Associates" under By-law No. 39 are marked*.

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Anderson, John Drummond, Trail, B.C.	13th April, 1892
Apsey, John Fletcher, Cumberland, Md. Grad. S.P.S.	6th Jan., 1886
Aylsworth, Charles Fraser, Sr., Madoc D.L.S.	2nd April, 1861
Blake, Frank Lever, Toronto, Meteorological Office D.L.S.	13th April, 1875
Bell, Andrew, Almonte D.L.S.	6th Oct., 1866
Booth, Charles Edward Stewart, Westmount, P. Q.	6th April, 1882
Bowman, Arthur Meyer, Mahan, Beaver Co., Pa. Grad. S.P.S., Staff of U.S. Engineers.	11th Nov., 1887
Bowman, Franklin Meyer, Bellevue, Allegheny Co., Pa. Grad. S.P.S., Engineer Structural Iron Works.	11th April, 1892
Brady, James, Victoria, B.C., P.O. Box 815 M.E.	15th July, 1862
Burnet, Hugh, Victoria, B.C. P.L.S. (B.C.).	5th April, 1887
Cambie, Henry John, Vancouver, B.C. P.L.S. (B.C.).	8th July, 1861
Carbert, J. Alfred, St. Joseph, Mich. D.L.S. Staff of U. S. Engineers.	7th April, 1876
Coleman, Richard Herbert, Toronto, Canada Co. Offices, Imperial Bank Chambers	6th Oct., 1877
Drewry, William Stewart, Ottawa, Dept. of the Interior D.L.S.	5th April, 1883
Edwards, George, Thurso, P.Q. D.L.S.	6th Jan., 1866
*Ellis, Henry Disney, Kuching, Sarawak, Borneo D.L.S., Commr. of Pub. Works and Surveys.	7th April, 1877

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Galbraith, John, Toronto, School of Prac. Science M.A., D.L.S., Prof. Engineering S.P.S.	13th April, 1875
Gibbons, James, Ottawa, Dept. of the Interior Grad. S.P.S., Dominion Topographical Surveyor.	15th April, 1890
Gibson, George, St. Catharines D.L.S.	10th April, 1860
*Gilmour, Robert, Toronto, c/o Western Loan Company D.L.S., C.E	11th April, 1856
Green, Thomas Daniel, Dawson City D.L.S.	7th Jan. 1885
*Harris, John Walter, Winnipeg P.L.S. (Man.), D.L.S., Assessment Com.	6th Oct., 1866
Henderson, Eder Eli, Henderson P.O., Maine Grad. S.P.S.	7th April, 1887
Hermon, Ernest Bolton, Vancouver, B.C. P.L.S. (B.C.), D.L.S.	7th Oct., 1885
Innes, William Livingstone, Simcoe C.E., (Toronto Univ.)	14th April, 1892
James, Silas, Toronto, 77 Victoria St D.L.S.	19th July, 1858
Jephson, Richard Jermy, Calgary, Alta P.L.S. (B.C.), D.L.S.	7th April, 1877
Johnson, Sydney Munnings, Greenwood, B.C.	9th Nov., 1895
Johnston, Robert Thornton, New York, N.Y., 944 Amsterdam Ave	9th April, 1889
Kains, Tom, Victoria, B.C D.L.S. P.L.S. (B.C.).	11th July, 1873
Kirk, John Albert, Rossland, B.C D.L.S., P.L.S. (B.C.)	6th July, 1877
*Klotz, Otto Julius, Ottawa, 437 Albert st C.E. (Mich. Univ.), Dominion Topographical Surveyor.	6th Jan., 1876
Lane, Andrew, Sparrow's Point, Md Grad. S.P.S., Draftsman Maryland Steel Co.	4th April, 1895
Lendrum, Robert Watt, South Edmonton, Alta D.L.S.	8th Jan., 1874
Livingstone, Thomas Chisholm, Winnipeg, Man. D.L.S.	10th Jan., 1859

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
MacLeod, Henry Augustus F., Ottawa, 340 Cooper st. C.E., D.L.S.	11th Oct., 1856
McCulloch, Andrew, Lake Nelson, B.C. Grad. S.P.S., Assoc. Mem. Can. Soc. C. E., City Engineer.	
*McMullen, William Ernest,, St. John, N.B. Asst. Eng. C. P. Ry.	11th Nov., 1892
Magrath, Charles Alexander, Lethbridge, Alta. B.A.Sc. (McGill), D.L.S., P.L.S. (B.C.).	1st Nov., 1881
Moore, Thos. Alexander, London South	12th Nov., 1892
Munro, John Vicar, New York, N.Y., 359 West 31st st	9th April, 1895
Pearce, William, Calgary, Alta D.L.S., P.L.S. (B.C.).	12th Oct., 1872
Ponton, Archibald William, Ottawa, Dept. of Interior D.L.S.	9th April, 1880
Pope, Robert Tyndall,—— Ireland C.E., D.L.S.	13th April, 1875
Purvis, Frank, Mesa City, Arizona	7th April, 1875
Reid, John Lestock, Prince Albert, Sask D.L.S.	8th April, 1870
Reiffenstein, James Henry, Ottawa, Dept. of the Interior D.L.S.	16th April, 1873
Reilly, William Robinson, London, 361 Simcoe st D.L.S., P.L.S. (Man.)	7th April, 1881
Ritchie, Nelson Thomas, Kipiegan, Man	9th Nov., 1888
Rogers, Richard Birdsall, Peterborough B.A.Sc. (McGill), D.L.S.	9th Jan., 1879
*Ross, Joseph Edmund, New Westminster, B.C. P.L.S. (B.C.).	11th Nov., 1890
Sanderson, Daniel Leavens, Coral, Mich	4th Oct., 1882
Shaw, Charles Æneas, Greenwood, B.C P.L.S. (B.C.).	6th Oct., 1877
Sherman, Ruyter Stinson, Vancouver, B.C. P.L.S. (B.C.).	12th April, 1890
Simpson, George Albert, Winnipeg Man C.E., D.L.S., M.P.	7th Oct., 1864
Spry, William, Toronto C.E., D.L.S.	19th July, 1858
*Stewart, Louis Beaufort, Toronto, School of Prac. Science Dominion Topographical Surveyor, Lect. in Surveying.	6th April, 1882

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Strathern, John, Vancouver, B.C. P.L.S. (B.C.), D.L.S.	5th Oct., 1876
Tracey, Thomas Henry, Vancouver, B.C. C.E., P.L.S. (B.C.), D.L.S	8th April, 1870
Vicars, John Richard Odlum, Kamloops, B.C. D.L.S., P.L.S. (B.C.).	5th Jan., 1887
Wallace, Charles Hugh, 36 Dame St., Dublin, Ire. C.E. (Trin. College, Dublin), Dom. Gov. Surveyor.	9th Nov. 1889
Weekes, Abel Seneca, Wetaskiwin, Alta. D.L.S.	12th April, 1890
Wheeler, Arthur Oliver, New Westminster, B.C. P.L.S. (B.C.), D.L.S.	8th July, 1881
Willson, Alfred, Toronto, Can. Co. Offices, Imperial Bank Chambers D.L.S., Commissioner Canada Company.	6th Oct., 1866
Wilkins, Frederick William, Ottawa, Dept. of the Interior Dominion Topographical Surveyor.	6th Jan., 1877

SUMMARY.

Active members subject to dues	205
Active members exempted from dues	18
Withdrawn from practice (including Associates)	63
Dead	30
Total number enrolled since incorporation	316

Deceased Members.

NAME.	LATE RESIDENCE.	DATE OF P.L.S. CERTIFICATE.	DATE OF O.L S. REGISTRATION.	DIED.
Bolger, Francis	Lindsay	10th October, 1863	1892	3rd November, 1895
Bowman, Leander Meyer	Toronto	14th April, 1892	1892	20th September, 1895.
Brown, David Rose	Cornwall	10th October, 1850	1892	14th May, 1900.
Burke, William Robert	Ingersoll	5th April, 1878	1892	10th June, 1897.
Caddy, Edward C.	Cobourg	18th December, 1846	1892	26th September, 1897.
Coad, Richard	Glencoe	8th October, 1879	1892	17th May, 1897.
Creswicke, Henry	Barrie	8th July, 1864	1892	22nd January, 1898.
Cromwell, Joseph M. O	Perth	1st October, 1846	1892	19th October, 1897.
Deane, Michael	Windsor	26th May, 1848	19th December, 1892	3rd April, 1897.
DeGurse, Joseph	Windsor	5th April, 1883	1892	22nd March, 1898.
Foster, Frederick Lucas	Toronto	9th April, 1863	1892	27th July, 1899.
Fowlie, Albert	Orillia	13th January, 1863	1892	—— April, 1898.
Gibbs, Thomas Fraser	Adolphustown	31st May, 1841	1892	17th April, 1893.
Gilliland, Thomas Brown	Eugenia	11th July, 1868	25th January, 1896	14th December, 1898.
Haskins, William	Hamilton	5th July, 1855	1892	5th July 1896.
Hewson, Thomas Ringwood	Hamilton	6th July, 1877	1892	21st October, 1898.
Howitt, Alfred	Gourock	12th January, 1856	1892	6th May, 1896.
Kirk, Joseph Green	Stratford	16th February, 1843	1892	22nd January, 1900.
Lynch-Staunton, Francis H	Hamilton	11th October, 1856	1892	11th June, 1899.
MacMillan, James Alexander	Calgary	6th January, 1877	24th December, 1894	—— ——, 1898.
MacNab, John Chisholm	Hamilton	8th January, 1880	1892	16th October, 1897.
McCallum, James	Fort Frances	30th March, 1849	1892	—— July, 1900.
Malcolm, Sherman Morgan	Blenheim	11th October, 1858	1892	13th January, 1899.
Ogilvie, John Henry	Rat Portage	8th April, 1876	24th April, 1894	21st September, 1898.
Pedder, James Robert	Doon	10th November, 1891	23rd December, 1892	17th January, 1897.
Reid, James Hales	Bowmanville	6th October, 1866	1892	22nd December, 1899.
Robinson, William	London	—— May, 1846	1892	11th October, 1894.
Thomson, Augustus Clifford	Chicago	14th January, 1861	1892	—— December, 1896.
Walsh, Thomas William	Simcoe	25th April, 1842	1892	14th March, 1895.
Wheelock, Charles John	Orangeville	—— ——, 1856	1892	4th July, 1897.

OBITUARY.

JOSEPH GREEN KIRK.

Joseph Green Kirk was one of the oldest and best known of the early settlers in the county of Perth, Ontario. His illness, which extended over several years, did not confine him to the house until the beginning of this year. He was born in Londonderry, Ireland, on September 12, 1809. He was educated by a private tutor, his studies having special reference to his chosen calling, that of a civil engineer. In 1829 he left Ireland for Canada, settling in Bytown, now the City of Ottawa, where he practised under Mr. John Robertson, a civil engineer of that place. In 1843, having received a commission to practise as a land surveyor, he moved to Goderich, and shortly afterwards to Stratford. In 1845 he was appointed engineer for the Huron district, comprising the Counties of Perth, Huron and Bruce of to-day. When the district was separated into counties his duties were confined to the County of Perth. He resigned this office in 1872, and devoted himself mainly to a private practice. In 1878 he was employed by the Town of Guelph, in 1884 by the Town of Minnedosa, Man., and for many years in Stratford and adjacent municipalities in his professional capacity, having charge of local improvements in those places. In 1837 he volunteered as a private in the militia. In 1847 he received a commission as a Lieutenant in the 4th Battalion of the Huron militia, and was connected with the 1st Perth Battalion holding the rank of Captain. A commission as Justice of the Peace was given him in 1858. In the early days of Stratford he sat in the Council. He was a member of St. Andrew's Presbyterian Church, and filled the position of elder for many years. He died at his home in Stratford on 22nd January 1900. In private life quiet and unselfish he was endeared to all who knew him.

He leaves a widow and one son, Mr. J. A. Kirk, of Rossland, B. C. Two sisters also survive him, living near Ottawa.

ADDITIONS TO MANUAL.

Rev. Stat. c. 180, s. 28 amended.
Shortened term of apprenticeship.

1. Section 28 of *The Ontario Land Surveyors' Act* is amended by inserting after the word "engineering," at the end of the fifth line thereof the words, "or the School of Mining, Kingston, in civil engineering or in mining engineering." 63 V. c. 22, s. 1.

See page 11, Sec. 28 Manual.

Rev. Stat. c. 181, s. 39 amended.

22. Section 39 of *The Surveys Act* is amended by adding the following subsections thereto:—

Allowance for road when closed to belong to adjoining owner.
Rev. Stat. cc. 136, 138.

(4) Where under subsection 1 of this section any allowance for a road or street laid down upon a plan is a public highway but the municipal corporation has not assumed the same for public use, then in case the said allowance or any part thereof is closed by an alteration of the plan under section 110 of *The Registry Act*, or section III of *The Land Titles Act*, or other provision in that behalf, the allowance so closed shall belong to the owners of the lands abutting thereon.

How owners of abutting lands to take.

(5) Where several parcels of land having different owners abut on the allowance so closed, the owner of each parcel shall be entitled to the portion of the allowance so closed on which his land abuts, and shall be so entitled to the middle line of the said allowance, and where there are several owners of an abutting parcel each shall be entitled to the like estate or interest in the said portion of the allowance as he has in the parcel of land abutting thereon.

When allowance abuts on one side on a stream, etc.

(6) Where any portion of the allowance so closed is abutted on one side by another road or street, or by a stream, river or other body of water over which the public have rights of navigation or of floating logs the whole width of such portion shall belong to the owners whose lands abut thereon opposite the said street, stream, river or water.

Division line.

(7) The division line between two adjoining parcels produced to the middle line of the closed allowance or across such allowance in cases coming within subsection 6 shall be the division line between the portions of the closed allowance to which the owners of the said parcels shall be respectively entitled.

When incumbrancers to be deemed owners.

(8) A person who has an incumbrance on a parcel of land abutting on the allowance closed shall be deemed an owner of such parcel within the meaning of the four next preceding subsections. 63 V. c. 17, s. 22.

See page 33, Sec. 39 Manual.

Charles Potter

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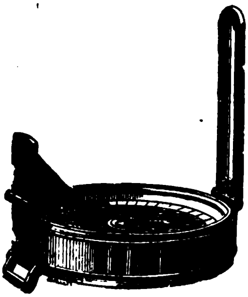

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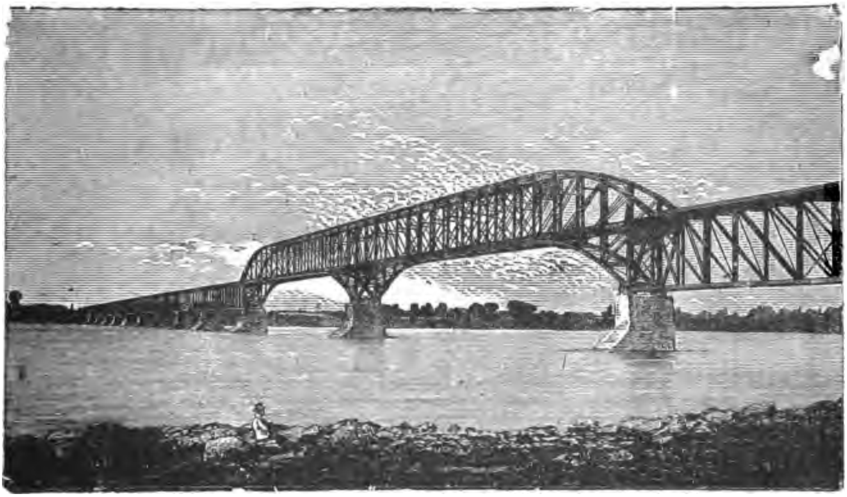

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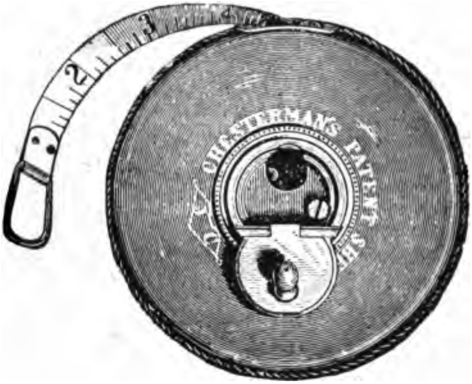

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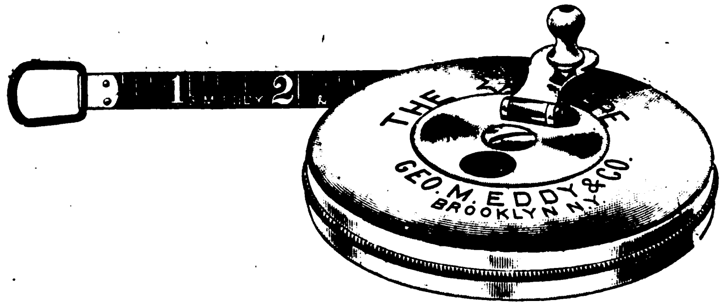

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